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JUNE 1988 £1.50

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Archimedes

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MASSES OF MIDI MUSIC HARDWARE MUST BE WON!

CUT OUT AND KEEP

Arc modules reference manual

SPYCAT

An Interactive Exposé of M.I.4½

The London Skyline Viewed from Blackhall

Outside No. 10 Drowning Street

Meeting the P.M.

Waiting to see "M"

All the Thrills and Intrigue of the World of Espionage

Spycat is a skilfully-written arcade adventure game which takes place amongst the corridors of power in Blackhall, Drowning Street and the M.I.4½ underground surveillance complex.

You play the role of Spycat: a cat with a purpose. You are devoted to spending your life embroiled within the fascinating but dangerous arena of professional secrets. It's a good career — full of security; and when you retire you can always supplement your pension by emigrating to Greenland and publishing your memoirs.

The game features nearly 100 different screens, with 30 different objects — including computers and passports — to locate and employ in appropriate ways. An icon-driven control system is used to orchestrate your manoeuvres and actions. There are secret passages to discover, and hatches and lifts to assist your progress. Guest appearances are made by: the Prime Minister and the spy-chiefs "Q" and "M".

Spycat is a thoroughly captivating game. To complete the adventure, you will need to use clear logical thought as well as fast reactions and arcade skills. Your life as an undercover cat may not be easy but it will always be exciting!

BBC Micro Cassette	£9.95	Acorn Electron Cassette	£9.95
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(Compatible with the BBC B, B+ and Master Series computers)

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The first prize in our competition is a specially-produced ESPIONAGE KIT (worth over £100) comprising: quality prism binoculars, a mini camera, a mini cassette-recorder, invisible ink pens, and a book on codes and ciphers. There are 20 congratulatory certificates for runners-up.

To enter the competition, you must complete the game and write to us describing the final messages that you receive.

Closing Date: 31st July, 1988.

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ACORNSOFT

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With Digimouse add **£35**

The ARTROOM pack consists of ARTROOM and ACE (Artroom Colour Extension). ARTROOM is an icon based full screen graphics package which can be controlled by mouse or keyboard. All the usual features are there including 'cut and paste' and our highly acclaimed ZOOM option plus an extensive graphics library to help you produce pictures quickly. An advanced printer dump is also supplied.

'ARTROOM...the best there is.'— Acorn User Feb '87

'ARTROOM is the software for you.' A & B Jan '87

ACE consists of two programs. COLOURIZER enables you to produce MODE 1 colour versions of ARTROOM screens and to dump them to a printer using a shaded printer dump. The MODE CONVERTER program will convert any graphics screen into a Mode 4 ARTROOM screen ready for loading into ARTROOM. Conversions can be made from Modes 0,1,2,5 and 7. yes SEVEN!

'...very pleased with the way Clares have introduced the colour facility.' A & B June '87.

ARTROOM and ACE will work with any mouse but we recommend DIGIMOUSE because it is well engineered using a non-slip ball and optical encoders. DIGIMOUSE also includes the unique 'LINEAR LOCK' facility that enables you to draw straight lines freehand.

'...impressed by Nidd Valley Digimouse' A & B June '87

This complete package is marketed by Olivetti in Italy, the home of style and design.

ACE A STROKE OF GENIUS!

BETA-BASE SAVE £7

£30 5.25 inch Disc £34 3.5 inch Disc

The Beta-Base pack consists of Beta-Base, the number one database for the BBC micro, and Beta-Base Utilities which extends the power of Beta-Base.

The main feature of Beta-Base is its ease of use which is achieved without sacrificing the power and flexibility required for the efficient manipulation of up to 65,000 records.

The Beta-Base Utilities provide seven new utilities. There are more powerful versions of Search and Sort and there is also a Mail Merge program which creates perfectly formatted letters containing data from your files.

'We use Beta-Base ourselves' Mike Bibby, Editor of MICRO USER.

'Rated best value for money'—ACORN USER Dec '84

RAMROD

UTILITIES PACK

SAVE UP TO £30

£50 5¼ inch disc £60 ROM £54 3½ inch disc

The UTILITIES PACK consists of RAMROD and MACROM. RAMROD is the ultimate toolkit ROM and it is compatible with the whole BBC range and includes a disassembler plus editors for DFS, ADFS, RFS, memory, Shadow memory, Sideways RAM, Tube plus lots more. RAMROD will take you to the furthest reaches of your machine and enable you to boldly go where no ROM has gone before!

'an ingenious collection of utilities...' BEEBUG Oct '86

'worth its weight in gold.' A & B Jan '87

MACROM is a fast full featured MACRO ASSEMBLER that allows the use of macros, which are loaded from disc. MACROM has its own easy to use editor which automatically formats your source code. A HI version of MACROM is supplied for use with the second processor. A macro library and demonstrations are also supplied.

'Full marks for an excellent product.'—BEEBUG JUNE 1986

We are also making BROM+ available under this offer. Its main feature is the full scrolling BASIC editor which allows the user to edit a program as if dealing with text in a wordprocessor. There are many other features dedicated to making life easier for BASIC programmers.

'This is the best BASIC screen editor I have so far used.' —MICRO USER August 85

For BROM+ add £25 on ROM, £20 for 5.25 inch disc or £22 for 3.5 inch disc.

When ordering please state the following:

Machine
Disc size (5.25, 3.5)
Disc format (40 or 80)
DFS version

N.B. If ordering for a Master or Compact please state DFS or ADFS. The ARTROOM pack is for the Master or Compact only but all other software is available for all machines.

Fontwise + Pack SAVE £10

£30 5¼ inch Disc **£34 3½ inch Disc**

The FONTWISE+ pack contains FONTWISE+, the FONT EDITOR and 22 fonts. FONTWISE+ enables you to print very high quality text in a choice of 22 different fonts and 3 sizes. You do not need a special printer, just an EPSON RX or FX compatible. High quality is not the end of the story because you can also have both proportional and justified text. The output has to be seen to be believed.

FONTWISE+ is compatible with WORDWISE, VIEW, INTERWORD, MINI OFFICE II and EDWORD II.

'FONTWISE is better than many NLQ packages'—ACORN USER Sept '86

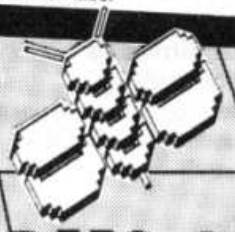
The FONT EDITOR is very easy to use and allows you to edit the current fonts or create new ones. Reviewers have praised the editor for its ease of use and faultless presentation.

'editor is impressively quick, smooth and easy to use'—A & B

EDITOR '...puts all previous designers to shame.'—BEEBUG July '86

Ask for a sample printout.

Suppliers of top quality software for the range of Acorn Computers



Clares

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Volume Five Number Six June 1988

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BBC BASIC on IBM PCs, Apple Macintosh, Z88 and Archimedes
How easy are files to transfer? What memory is available for programs? What changes need to be made?

Archimedes
HARNESS THE POWER

Alpha-Base

£49.95

Alpha-Base is the successor to **Beta-Base,** the top selling database for the BBC micro. Alpha-Base really does **'HARNESS THE POWER'** of the Archimedes. As with all Clares products we have made **Alpha-Base** powerful but easy to use. You can be using a database within 5 minutes of receiving the program - that's easy. But don't be fooled, you do not lose any functions or power. Here are just some of the functions:

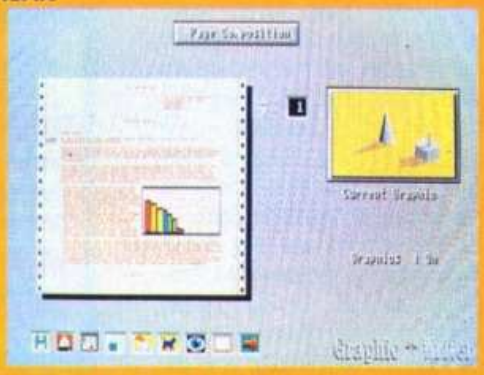
* WIMP based using icons and mouse
* Hard disc compatible - massive files
* Free format screens with on line editing of field order
* Upto 400 fields & 27600 chars per record
* Upto 2.14 billion records per file !!!
* Multiple display, entry and printer forms can be used with each file
* Fast search by fields or record
* Plain English entry of search & sort criteria with many inbuilt functions
* Five data types including formulae
* Calculation facilities with inbuilt min, max, average, age etc
* Comprehensive print options inc labels
* Validation on each field if required
* Transfer fields from one file to another
* Password security if required
* Data stored on disc so computer failure will not result in loss of the data

If you want a powerful database that you can boot up and run within 5 minutes then buy **Alpha-Base** now. Absolutely no programming skills required.

Graphic Writer

£29.95

Graphic Writer, formerly Image Writer, is a sophisticated WIMP based word processor with an inbuilt graphics editor. It can be used as a standard word processor or graphics can be included to provide diagrams, graphs etc within your document. Graphics can even be imported from **ARTISAN**



* Totally icon driven from menus
* Multiple documents in memory, upto 512k
* Super smooth scrolling
* Fast search & replace
* Justify centre etc
* Text styles give plain, bold, italic, underlined, subscript, superscript or combinations of these eg bold italic underlined subscript.
* Centered and Temporary text styles
* Block operations - move, copy, delete and recall
* Full WYSIWYG preview
* Graphics editor
* Page format controls page length, headers, footers, pad and pound characters.
* Page Composition allows placing of graphics, mini preview etc
* Multiple print out options
* Auto page numbering even through multiple documents

To create a document with **Graphic Writer** you type in your text, using the many text styles available, leave room for the graphics and then place the graphics using Page Composition. It's simple and easy to use. You can have up to 14 documents in memory on a 310, that's equivalent to about 220 pages of A4 text.

See what the magazines say:

> the scrollling is unbelievably smooth... I can highly recommend this excellent product as being **THE** word processor for the Archimedes
>
> *MICRO USER April 1988*

> excellent value... bowled over by its stunning use of graphics.
>
> *RISC USER December 1987*

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NEWS

Teletalking

Last month a free bottle of cheapo Spanish plonk arrived on the desk of Darrin "it's 9.30 in the morning so i'll play Postman Pat" Williamson – of course the package bore the distinct resemblance to a bottle mailer and it was, of course, leapt upon by Mark Webb and my good self.

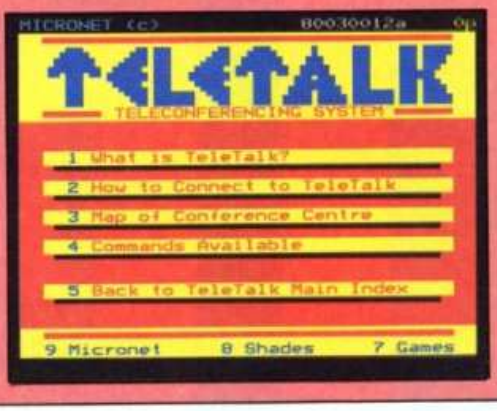
Nobody these days sends alcohol through the post without good reason, and this time was no exception! It was to "celebrate" the launch of **Teletalk** – a special service to Micronet offering a teleconferencing facility set up using a Modem and a Beeb.

This is not a new idea. British Telecom's late (un)lamented *Talkabout* services for dull spotty social outcasts offered a similar facilities but with Teletalk, you use a computer to walk into "rooms" and "speak" with people – this can be a celebrity, a manager of a company or even our Editor, Mark Webb (!), comfortably numb after downing half a bottle of chateau Lorret de Mar!

The launch was amusing, proving that Micronet are still at the leading edge of cleverly disguising "charge time" and calling it a new service (which it is).

Will people use Teletalk? Will it become a "supported feature" of Micronet, or will it just be a gimmick enabling kids to bump up massive telephone bills (as was done with Talkabout) remains to be seen – amidst all the media hyperbole I have a feeling it will, providing there are enough users.

Next time a Bollinger would go down nicely Micronet.



King of the Castle

We had to take a break after receiving this press release from AMT Ltd after they proudly proclaimed their PC as being "The UK's fastest Microcomputer", I mean, were these guys serious?

***Apparently* their machine runs at 25 MHz, runs twenty eight times the speed of an IBM PC (can't be difficult), and still run all native 80386 packages under MS-DOS, has 16 megabytes of paged memory and can address a "potential address space" of 4 gigabytes.**

Now I know you are all worried sick over the fact that our beloved Archimedes claims to be the fastest micro in the world, and that with a spec like AMT's there seems to be a little confusion over "who is the best", but what we have here is a fast little processor (and it is), tied down by a lumbering great operating system, the EGA standard (ie, 640 x 350 colour graphics), and with the wonderfully innovative software that the IBM PC can run (ie, very little).

Add to this the truly horrifying price tag (ring them up if you dare) and I think the distinction is clear; AMT have built a minicomputer running IBM PC software very fast – something the Archimedes can do for just an extra £90 outlay!

Sorry AMT try again.

Contact TEL (01) 450 3222 for more information.

Beavering on the Master 512

Lets face it, there aren't too many integrated Sales prospect and Time Management systems available for the Master 512 (and consequently IBM PC machines) and the Archimedes in PC emulation.

I went to a demonstration of this interesting package last week, and I must admit I was a mite impressed, it is a sort of scratch-pad for salesmen wishing to set up a sales database with an order of priority, sales leads, appointments and quotation handing system.

This is the sort of software that will sell master 512's if the price is right, and for £9.95 you can't really go far wrong can you? It is also a time manager – a sort of floppy bound filo-thingy, which makes timekeeping and appointments managing a good deal easier too.

Cute beaver too.

The System works only for IBM PC machines – therefore only Master 512 users can access the facilities on this disc, but it is worthwile if you are a salesman, and you use the Master 512.

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For Archimedes users

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BEEBUG

The magazine is now in its sixth year of publication with 20,000 subscribers throughout the world. Its proven format has been invaluable to serious BBC Micro and Master computer users in the home, education and business.

Each issue of BEEBUG provides 72 pages of articles, programs (utilities, applications etc), tutorials, workshops, reviews, hints & tips, news and information to beginners and experts alike. All our programs are tested on all versions of the BBC Micro, and are also available monthly on disc or tape.

RISC USER

This is the magazine for anyone interested in Acorn's RISC computer, the Archimedes. Launched at the same time as Archimedes, RISC User provides lively and informed coverage of what's happening in the world of Archimedes.

Reviews, hints, programs and articles are all specifically written for Archimedes, showing how to exploit the many features of this sophisticated computer. RISC User is all about the Archimedes, it does not contain modified programs originally intended for the Model B or Master.

BEEBUG and RISC User are both published 10 times a year and are only available on subscription, not through the shops.

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AB 6

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A310M Base	£96.25	£96.00	A440 Base	£267.85	£264.00
A310M Mono	£108.75	£101.00	A440 Mono	£271.35	£270.00
A310M Colour	£119.25	£119.00	A440 Colour	£290.85	£287.00

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BBC Issue 7 DFS (Or B+)	£225
Master 128	£250
Compact Base System	£215

Please phone for allowances on other Compact and Master systems.

3 FREE DISCS & PC EMULATOR

Join RISC USER, the Archimedes magazine and support group, and purchase your Archimedes by Cheque, Access, Visa, Official Order or 11.5% finance and we will supply you, absolutely free, 10 3.5" discs, a lockable disc storage box, printer lead and the latest version of The PC Emulator from Acorn. Altogether you save more than £142.00.

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We offer a complete service, including Advice, Technical Support, Showroom, Mail Order and Repairs. Our showroom in St. Albans stocks everything available for the Archimedes. Call in for a demonstration.

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I enclose a cheque value £.....
Please debit my Access/Visa/Connect Card No
Expiry...../..... with £.....

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AB 6

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BEEBUG – The Archimedes Specialists

Another Music Database on Prestel

Hot on the heels of Music City (see review in this month's A&B) comes another music database for Prestel users; called *MusicFocus, it comprises of over 200 frames of information.*

Something Prestel has never really achieved – yet it has been more than adequately taken up by CEEFAX and ORACLE – is a nationwise "Gig Guide", this contains nearly 40 pages of new live acts as well as up to date information regarding concerts, reviews and a professional section containing the telephone numbers of radio stations and record companies.

This looks to be great fun! At last someone seems to be looking into using Prestel as direct (albeit costly) competition for CEEFAX. Okay, so some of the frames are priced at the usual rate of 1p to 2p per frame, but most of the frames are free.

*To access MusicFocus, simply access Prestel and turn to page *3450# or type *MusicFocus – couldn't be easier.*

The ball is in your court.

For more information, contact Rob Randall, Music View Limited, 8 Wellington Close, Walton-on-Thames, Surrey, KT12 1AX.

Minerva and the art of Hyperbole

Well, it had to happen, Minerva systems – no strangers to the word Hyperbole – have just released what they claim to be the worlds largest and fastest spreadsheet on any micro.

They claim that their SigmaSheet package for the Archimedes runs 1600 times faster than ViewSheet (which isn't difficult), can create spreadsheets seven times the size of Lotus 123 (which is possible using 123 clones), and can run over 200 times faster than InterSheet and Logistix (which is, I must admit, quite fast).

What is very interesting, is that SigmaSheet makes use of the maths co-processor (if fitted), which seems to suggest that the new boards are finally off the drawing boards and are going to be a reality.

There has, as yet, been no price fixed for SigmaSheet, but if you care to ring them on ☎ (0392) 37756/410137, perhaps they may be able to impart more information for you.

Yamaha Go Into Education

Yamaha – musical instrument manufacturers have produced a 20 page newsletter called **YES,** an acronym for Yamaha Educational Suppliment, and this follows on from the success of the newsletter that was sent out to all owners of the DX range of synthesisers (called **Express**) You can subscribe to either of these free magazines (and they are both very informative) by simply writing to

Yamaha-Kemble Music Ltd,
Mount Avenue, Blethchley,
Milton Keynes, MK1 1JE.
☎ (0908) 71771.

PMS Polish up their Lamp

A funny thing happened after PMS launched the Genie Watch - a Real Time Clock for the BBC B – it seems that a Genie Master Compact user rang them up and asked them if it would work on their system.

"Certainly not", came the confident reply, "It doesn't work on the Master Compact".

"Oh, Ok then, bye!" said the disappointed user, and he disappeared into the ether where all Master Compact users go.

The thing is that the RTC Watch *does* work on the Master Compact, albeit with a few "weirdies", so PMS rewrote the code and gave birth to a new product called The Compact Clock **– so now Compact Genie owners can use the watch facilities of the Master *and* a few extras too, such as an alarm facility, and a count down timer.**

At £35 for the Compact Clock, I think there will be a lot of Master Compact owners crying out for this product.

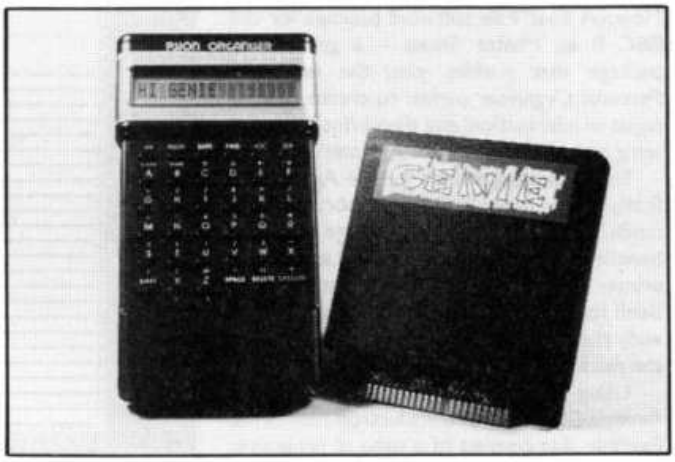
● Along similar lines comes the news that PMS have doubled the memory capacity of the 32K Genie and taken it up to 64K – well, it was on the cards I must admit, but the really exciting thing is that the upgrade will cost just £25.

● The Master Cartridge version of Genie has now been converted so that it will accept a 16K sideways RAM chip, thus retrieving the socket taken up by the Genie hardware*and* giving you a battery backup option. The 16K RAM costs £15 or £20 with battery backup.

● Genie Junior has been revamped so that it will now work with Hard disks (such as Acorn and Watford winchester discs) and Opus Challenger type RAM discs. With such devices, Genie Junior runs as fast as the battery backed Genie – but at a third of the price – not bad at all.

● And finally, for all you high-tech yuppies; you can now transfer all your data from Genie into a Psion Organiser or a Sinclair... (oops Freudian slip) *Cambridge* Z88. The price of the package is a Filofax-busting £2 – that roughly translates into disk and postage charges only!

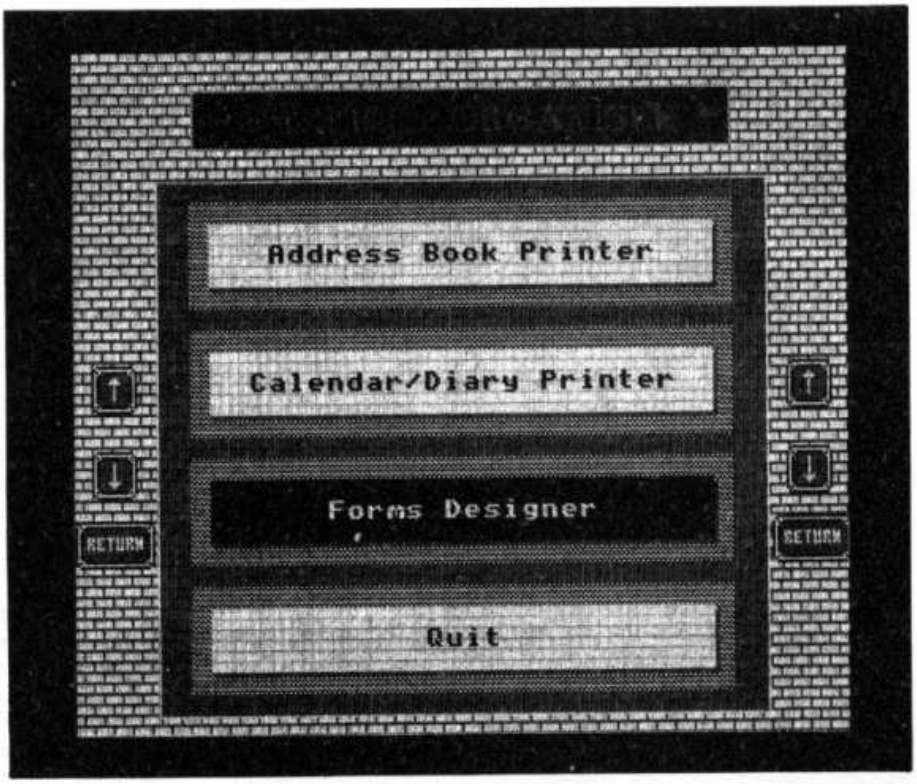
For more information about all these goodies contact PMS at:
***38 Mount Cameron Drive North, St Leonards, East Kilbride, G74 2ES.* ☎ (03552) 32796**



Clive Grace

JUST THE FAX

An amusing little package for all Personal Organiser owners...



I must admit I do come in for quite a bit of stick when it comes to actually owning up to being a Personal Organiser fanatic; Mark, my Editor, is never one for personal insults, but as for the others at ASP.... well, some things are better left unsaid.

The truth of the matter is that a Personal Organiser (the Lefax type) had literally changed my life, I was a wreck beforehand, losing vital slips of information, misplacing all my names and addresses (an embarassing one that), and taking notes in a brand new notebook only to lose them the next day – only a considerable domestic walkabout (losing clumps of hair in the process) would bring the notebook back to me. I lost so many notebooks, bits of papers cheque books, credit cards and so on, that I was sure that the gremlins were had well and truly got me!

All that changed when I purchased my Personal Organiser, I had portable and accessible names and addresses. Immediately I was transformed from a no hoper, into a sharp never-lose-anything kind of guy – (I haven't lost my Personal Organiser – yet). (He's still a no hoper though! Ed.)

I was able to ring up contacts *immediately*, I was, as they say, pretty quick off the ball – which was a good thing, if you lose a story, it gets snapped up by someone else in no time at all!

The Software

Which Brings me to the subject of the Mewsoft **Fax*File** software package for the BBC B or Master Series – a great little package that enables you, the user and Personal Organiser owner to create custom pages of information, and then print them out using an ordinary dot matrix printer.

Similar packages exist for the Apple Mac, fitting quite nicely into it's corporate image mode, but the Apple's package has the benefit of running on the Apple Laserwriter printer and the very friendly front end, the Beeb has neither of these, so we have to do with the Epson FX80 – but at a fraction of the price!

Using friendly menus (looking like Acorn's Database for the Electron Plus 3) the Fax*File disc consists of a suite of programs: the Address Book printer, the Diary Printer, and the Forms designer; of the three, the forms designer is the most interesting package as it enables the user to create pages to their own specification – desktop publishing on a loose leaf scale!

The Address Book Printer

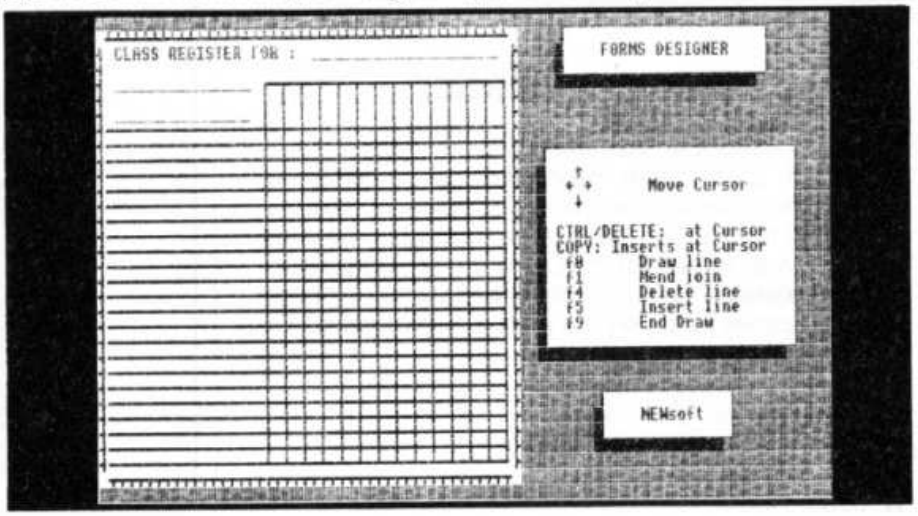
This option consists of a number of menu options, this is basically a database entry system with a specialised output - I must admit that the option of dumping page after page of names and addresses onto a loose leaf page did daunt me, but the output was legible (which is more than can be said for my handwriting) and with a new ribbon, well, anything's possible!

The address book data files are stored on a disc under the A Directory, so if you have the know-how, you can alter your own database files accordingly to fit the various output facilities, but more of that later.

The Diary and Forms Designer

The diary is the straightforward one-line-per-day version currently available, I would give it a miss!

The Forms designer is, as I said earlier, quite a useful option - this is loose leaf



publishing, so the software can cater for various forms sizes, line drawing, line *joining*, (a neat idea that), line deletion and line insertion.

Basically, the forms designer software is a pig to use, and a "kludged" version I had made in order to work with a few accelerators does wonders – perhaps MewSoft had better consider the option of implementing a 6502 second processor version, or rewrite the package to work in ROM – one way or another, the software is very slow and, unless you are very dedicated (as I am), you may find the forms designer annoyingly finniky.

So, after we have designed our page, we need to print out the form - but if you thought we would use something as barbaric as computer paper then you have another thing coming!

Continuous listing stationery exists for Personal Organisers with the traditional six-holes included! This is ideal for printing out and suits most, if not all printers, Although I prefer using individual blank Personal Organiser pages fed through using friction feed, some Epson printers will not like this. Still, if you can get away with this, then you will be at an advantage as the pages you print out can all be double sided – something that is not possible using continuous listing pages.

Just The Fax...

So is the package any good?

Certainly the software is capable of saving the user a lot of money; the software is not too expensive (anything for the Personal Organiser owner seems to be a license to extract every last penny from them).

The software is very well presented, and it does do the job, it's just that I wish there were more facilities on the forms designer – true, you can design just about any form you are going to need (double sided too if you are careful!) but the ability to create *detailed* pages with varying fonts and text pitches would have gone down nicely, a few circular shapes and faster software would be nice – not that it affects the performance of this software package, but perhaps a deluxe version...?

On the whole, this package is great fun, it is one of those amusing packages that does the job, albeit a little slowly, and thankfully it can be hacked into, so you programmers out there can add features and facilities as, and when, you like.

(Filo)Faxfile

Contact Mewsoft at: 11 Cressey Road, London, NW3 2NB. ☎ (01) 267 2642.

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- "Reference books are fine if you know what you are looking for. It's not just a case of new jargon, I simply don't understand what I have to do make my micro achieve these results."
- "I think of my computer now as little more than an expensive error of judgement. It only seems to be capable of playing games."
- "My original objectives about seriously using my computer are losing direction."
- "What I really need is help at a personal level. Somewhere that I can turn to that actually knows my complete computer system."

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INTER-**CHART**

A general purpose chart and graph plotting program that can display data in the most easily understood format—graphically.

While it integrates directly with other members of the 'INTER' family it can also accept data from ASCII files, produced by WORDWISE, VIEW and programming languages such as BASIC.

Supports line, and bar graphs, pie charts and also scatter graphs. These may be automatically scaling, or the user may view any portion of the scale so allowing 'zooming' into any area of interest.

Pie charts may have highlighted segments (pulled out) with the values optionally displayed as percentages.

All graph displays may have optional text headings or messages positioned anywhere on screen. These are saved with the graph and may be edited at any time.

Multiple graphs can be held in memory at the same time. Any number of graphs may be overlaid allowing easy comparisons etc. (Not applicable to pie charts.)

Graphs may be displayed in any BBC graphics mode. The colours of bars, lines, or segments may be altered from a simple table of colours. In addition special striped colour combinations and a variety of cross hatching styles are available for bar charts.

Where appropriate either axis may be displayed with a log or linear scale, and optional dotted graduation lines are available.

INTER-CHART has built in screen dump routines for EPSON matrix printers and compatibles. Other screen dump routines may be used from within (or external to) INTER-CHART for other printers or plotters.

BBC ROM—£32.00+VAT (£36.80 incl.)
Archimedes ROM £25+VAT (£28.75 incl.)

INTER-**WORD**

The ultimate word processor for the BBC Micro.

The most comprehensive WYSIWYG image of the final page showing at all times, page breaks, headings, footings, bold text, underlines etc, ensuring the page on screen looks as close as possible to the final printout.

Works in 40, 53, 80 or a special 106 column screen mode and offers super-fast scrolling in all modes, even sideways scrolling if necessary.

All margin and tab settings are controlled by rulers placed in the text. These may be altered by moving the cursor onto the ruler and simply dragging the required margin or tab to the new position. All text controlled by the ruler is instantly re-formatted to the new settings.

Pull down menus may control nearly all operations—no complicated commands to remember. This ensures that it really is easy to use.

Printer control menu allows easy access to all printers' special effects and allows easy configuring to any printer. Printer codes may be saved and re-loaded—no need for special printer drivers.

A special multi-file mode enables very long documents to be generated, even to the size of a disc, yet enables simple movement to any page in the document.

File selector for all file operations. This enables fast and very simple file name selection when saving, loading etc.

Integrates directly with other members of the INTER family and with SPELLMASTER, the fastest and most flexible spelling checker available for the BBC.

BBC ROM £49+VAT (£56.35 incl.)
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INTER-**SHEET**

A simple to use, but very powerful spreadsheet program offering many unique features.

The fastest spreadsheet available for the BBC Micro.

The largest capacity spreadsheet. This means more data and larger spreadsheets are possible.

40, 80 and a special 106 column screen mode. Especially useful for viewing large sheets.

Multiple spreadsheets in memory at once. Data from one may be included in the calculations of other sheets.

Super-fast replication allows anything from a single box to an area of the sheet to be copied to any other position. Formulae may be automatically updated relative to their new positions.

Simple WORDWISE like cursor movement.

A unique windowing system enables any row or column to be fixed on screen, while allowing the sheet to scroll underneath. Simpler than other windowing systems yet more flexible.

While it integrates directly with INTER-WORD it can also transfer data to and from other word processors such as VIEW and WORDWISE.

A large range of standard maths functions is included in addition to special spreadsheet functions such as AVERAGE, COUNT, IF . . ., LOOKUP, MAX, MIN, SUM etc.

Simple auto-prompting commands structure. If you can't remember the complete command syntax, just enter the first letter and INTER-SHEET will prompt from then on.

BBC ROM (2 chips) £49+VAT (£56.35 incl.)
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All the above ROMs are fully compatible with DFS, ADFS, Econet, all BBC machine variants and Watford or Aries shadow RAM boards.

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the single chip solution

A new single 1 megabit chip containing complete versions of all the above programs is now available. This replaces 4 chips and so offers a more compact and more economic way of obtaining the above three programs.

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Archimedes ROM not yet available.

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Dave Reeder

THE ARCADE

A bumper month – lots to review and lots to look forward to!

Game of the month

Saigon Tynesoft Model B/Master/ Electron Tape/disc £9.95/£14.95

Graphics/sound 8 Playability 8 Originality 7 Options – Value for money 8 Lifespan 8 Overall 8

Could also be *Commando II* This is excellent – Dave Croft and mystery programmer "Tequila" (I know who but I'm not telling!) have produced one of the most enjoyable games I've played since the last enjoyable game I played- even if it has taken them two years to do it.

As in other "lone soldier against the world" games, you move through a vertical scrolling landscape (no retreat possible), shooting the Viet Cong, exploring underground bunkers, getting shot yourself and all for what? If I ever get to the end, I'm sure there'll be a message saying **Congratulations! Now do it all again.**

Oh well, the graphics are great – lots of detail and the landscape is especially nice with jungle cover and underground trenches, etc. In fact they seem exceptionally close to Commando's graphics. Control of your soldier is easy but the semi-random appearance of the enemy isn't. And the screens provide just enough cover for you to be confident but not enough to be unthinking about your strategy.

As this is an early preview for Arcade readers, I didn't get instructions; but I suspect that there is extra ammo lying around – or are they copies of Mao's little red book? And there must be some purpose to the buildings that you can enter – maybe some of them hold prisoners of war or extra bullets. I hope it's the latter 'cos I need 'em. Pow! Pow! Pow!

Politically I think this is horrendous, but as a game I think it's great.

Phantom and Double Phantom

Doctor Soft Model B/Master/Electron Tape/disc £2.99/£4.99
Double Phantom Disc £9.95 (Both discs for £12.95)

Graphics/sound 8 Playability 8 Originality 7 Options practice, one/two player Value for money 8 Lifespan 8 Overall 8

A welcome re-release for the best flight simulator for the Beeb; after *Aviator* that is. Sophisticated but instantly enjoyable, this detailed combat simulator has several levels of interest – as a practice program, as a simulator, as a kind of double combat game and, with the special program and hardware link, a multi-user game on two different machines.

The last version is the most instantly impressive – each screen shows the player his own flight pattern and it is very disconcerting to watch your opponent slip in and out of sight, knowing that he has you pegged for an early crash pretty soon. This does require at least one disc drive, however, and of course two machines in the same room but it's worth arranging if you can.

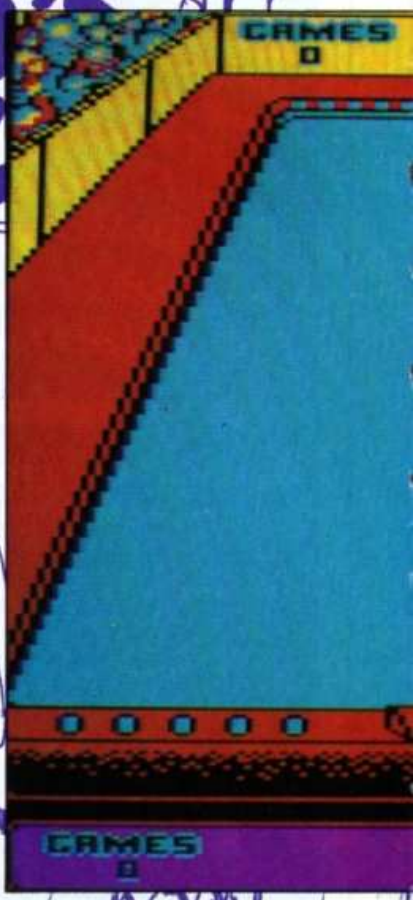
The basic package comes with a very detailed manual and many hours of enjoyment can be had learning to fly – Doctor Soft also produced the excellent *747* simulator, you may recall.

We gave this game a lot of coverage when it was first released – now at bargain prices, you have no excuse for not adding it to your collection.

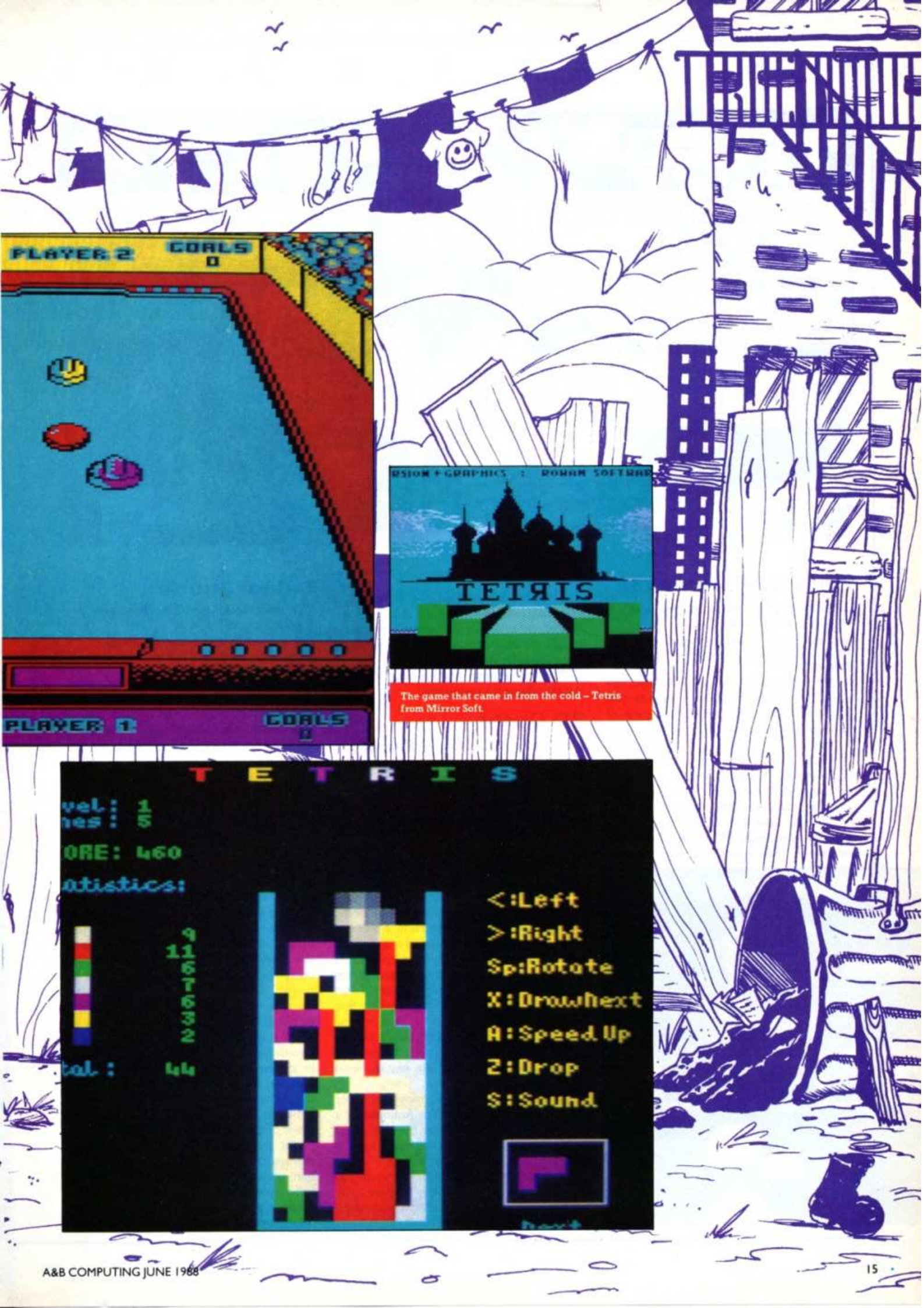
Double
PHANTOM
Combat · Flight · Simulator
WORLDS FIRST MULTI-USER COMBAT FLIGHT SIMULATION PACKAGE!
Each BBC (joined with HARDWARE LINK SUPPLIED) becomes a separate 'Phantom' supersonic fighter, sharing the same airspace, each visible AND vulnerable to the other!

arcade alley

Pack-Man gains a dimension in 3D Dotty from Blue Ribbon Software.



Air Hockey and Darts – just two of the games on offer on Indoor Sports from Tyne Soft.



The game that came in from the cold – Tetris from Mirror Soft.

FOR A+B 1988
BY TOBY GLOVER
©1988 Toby Glover
FRIENDS, WE ARE ALL GATHERED HERE TODAY TO PARTICIPATE IN A WONDEROUS EVENT.... AN EVENT EVEN MORE MOMENTOUS
THAN THE RELEASE OF "JOUST". YES, DEAR FRIENDS WE ARE TO OFFER THIS SAVAGE TO OUR LORD.
SO REPEAT AFTER ME...
PRAISE BE TO BOTTERILL!
PRAISE BE TO BOTTERILL!!!
AND IN THE VERY IMMORTAL WORDS OF OUR SAVIOUR...
DIE!
NEXT:.....!
NO THIS IS NOT THE SECRET MESSAGE!

Steve Davis Snooker

Blue Ribbon/CDS Model B/Electron
Tape/disc £1.99/£4.99

Graphics/sound 7 Playability 6 Originality 7 Options one/two player Value for money 8 Lifespan 7 Overall 7

Another welcome re-release in budget format, this game has apparently already sold more than 150,000 copies across a number of machines. By my reckoning, a good proportion of those purchasers will be very happy.

There have been snooker and pool simulations for the Beeb before, of course, but this is the best. Play a friend or Steve Davis (ie your Beeb) and you'll be amazed at the complex algorithms at work here – with each shot you choose direction, speed, spin and power. Then watch those reds slip into the pockets!

Not that it's that easy – a fair bit of practice is needed to keep the play under any sort of control, but the game is enjoyable enough for you not to worry when our Steve beats you again and again.

This was recommended at full price – as a budget release it's unmissable.

3D-Dotty

Blue Ribbon/CDS Model B/Electron
Tape £1.99

Graphics/sound 7 Playability 7 Originality 6 Options practice/sound Value for money 8 Lifespan 7 Overall 7

Some years back now there was a whole series of games from MRM based on a simple theme – forced 3D, lozenge shaped versions of *Pacman*. I think the last was *Crystal Castles*.

Now here's another variant, coded by J. Harris, and great fun it is too – a three tiered playing area, linked by ladders, in which our hero has to gobble up energy blobs (or whatever) whilst being chased round the board by a nasty. Not as easy as it sounds and not as boring as you might think. Extra difficulty comes with the various pillars that support the higher levels – because you obviously can't see behind them, it's easy to forget that there are areas you haven't yet cleared. And all the time the nasties move closer and closer.

This isn't gong to win many marks for originality but it's a perfect example of a good budget release, ideal for the newcomer or younger player. Not that more experienced hands won't enjoy it too and the practice option for all eight screens gives you a chance to fine tune your pattern play before dazzling an audience with your skills. Recommended.

Indoor Sports

Tynesoft Model B/Master/Electron
Tape/disc £9.95/£14.95

Graphics/sound 8 Playability 7 Originality 7 Options one/two player Value for money 7 Lifespan 6 Overall 7

I've already previewed this latest sports simulation by Tynesoft, who seem to have cornered the market in such games, and the finished package confirms the quality. Licensed from the States, the game has all the hallmarks we've come to expect from the in-house programmers, the Art Crew – good chunky graphics, solid gameplay, humourous touches. It's these last that, for me at least, give a game an edge over the competition – here, for example, one character says a word-ballooned "ouch!" if you mistime an action.

What you get for your money is four indoor sports – darts, ping pong, tenpin bowling and air hockey. Darts is the weakest and shows to the greatest extent the game's overall annoying factor – the blank screen that interrupts any event whilst a new perspective on it is being drawn to the screen. Besides, we've seen other darts simulations and they're universally disappointing. What isn't disappointing is air hockey, a bar game where a puck is hit by two bats on a tabletop. Here the graphics get in a muddle at times – it's possible, for instance, for your bat to both pass through the puck or sit on top of it at times. However, it's such a fun and compulsive event that it doesn't really matter.

Of the four events, tenpin bowling is perhaps the most ambitious with direction, spin, power and moment of delivery of the ball to worry about – very effective. But I'm keenest on ping pong – two playerless bats whacking a ball across the net. What especially

appeals is the coding of the ball – great perspective work and nice touches such as the shadow on the table changing with the ball's vertical movement above the table.

None of the events here are desperately exciting, but overall it's a very good package. Not too flashy, not too adventurous, the game demonstrates all of the Art Crew's strengths and will please all those who've come to rely on Tynesoft for the best in BBC sports simulations.

But surely they must run out of games to tackle soon – can there be more after the expected *Summer Olympiad?*

Tetris

Mirrorsoft Model B/Electron Tape/ disc £9.99

Graphics/sound 7 Playability 7 Originality 8 Options – Value for money 7 Lifespan 6 Overall 7

Seriously hyped as the first game to emerge from behind the Iron Curtain, this deserves more attention than curiosity value. Like all classic games, it is based on a very simple and very compulsive idea. Why did nobody think of it before?

The basic idea is easy to grasp – into a rectangle fall various shapes. Your mission – should you decide to accept it – is to ensure that through manipulation they fit and create a solid horizontal line across the box. Easy, huh? Not in the least! Despite the next shape being previewed, the time available for moving or twisting the object seems very short and, of course, you must plan ahead to ensure good fits.

I can't recall anything like this in the games world – like Breakout or Qix it is ridiculously simple in conception, but maddeningly difficult to achieve. The result? A great game that will keep you involved for a long time. I love it!

Gridiron

Top Ten Model B/Electron Tape £1.99

Graphics/sound 4 Playability 5 Originality 5 Options – Value for money 5 Lifespan 5 Overall 5

This is deeply disappointing, I'm afraid. Coded and released at speed (in part by Top Ten's Darryl Still – we name the guilty men!) because of the chart success by other formats, it is a BASIC only, text only American football manager package.

Now American football I find amazingly exciting – in fact, the only sport I watch – but this might just as well be about Association football. The usual decisions abound: buying/ selling players, etc etc. But it plays just like a magazine listing and has none of the features (like a title screen) that one would expect.

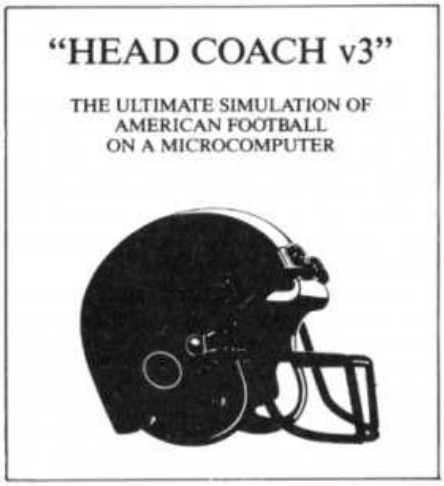
Sorry to be so negative but even with a player named Reeder in the game, I just can't get excited about it.

Head Coach v3

Coda Software Model B/Master Disc £13.95

Graphics/sound 6 Playability 9 Originality 8 Options – Value for money 8 Lifespan 8 Overall 8

Phew! I'm exhausted by this package – probably the most extensive American football simulation possible on a micro. It seems unfair to call it just a game.



You play the part of a football coach whose ambition is to win the Superbowl – well, why not? To do so you must guide your team, the Schoburg Franklins, through training camp, the pre-season, the season and the post-season play. At each stage the amount of detail available is staggering – each team in the League has full statistics available for all players, for example.

Play in the games is minimal but exciting – no real graphics, but a representation of the play position on the field. Before each play (offensive or defensive) you choose between twenty or more particular plays – will you attempt a shotgun? Or maybe a hail mary? Should the defense be 3-1-7 or 5-4-2? The computer then analyses the play and gives the result – 18 yard gain; incomplete pass, field goal; whatever.

It might be though that the lack of graphics at this stage would be a real disadvantage, but it's not true. The excitement level stands high and, as the season progresses, you gain confidence about the use of special teams, team selection, play decisions and so on. As the season continues, the package saves your rise (or fall!) in the League to disc, ready for next time. In fact, Coda make a point of stressing that the game shold follow the season though, updating data every game. They actually supply a new data sheet for players twice a year. So you could, for example, use the package to keep track of real games throughout the year.

But it would be a great shame to miss out on the play. As the game progresses the teletype results of other games and the worry about player and team suitability and fitness increases the excitement.

A lot of love and care has gone into this package and I'm conscious that I've only just skimmed the surface of its capabilities. If you have any interest at all in American football, then this game is a 'must have'.

Now then, I wonder if I can field a whole team of 'Refridgerators'?

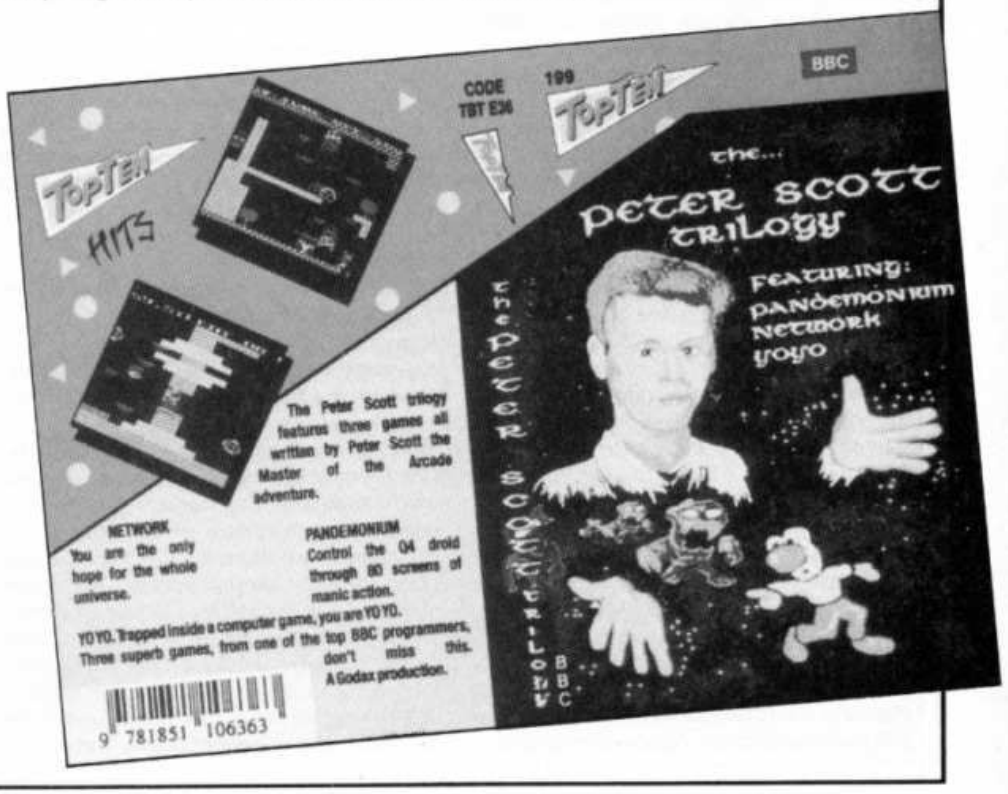
Triple threat

The Peter Scott Trilogy Top Ten Model B/Electron Tape £1.99

Overall 8

After we've been trailing this compilation for months, it's here at last and it's great. Fans of Peter's work will know what to expect, but for those new to his charming arcade adventures and zappers here are three earlyish games that reveal all the promise of his later work. Amazing value too – for just under £2, you get *Pandemonium, Network* and *Yoyo* – all releasable as full price games. All have much the same format – cute central character must explore loads of screens, solving puzzles, avoiding meanies, etc etc. But it Peter's graphics that such fun – the large, satisfyingly chunky graphics that are his trademark.

No more words – rush out and buy this one and then, of course, seek out his other great games: *Last of the Free, Hunkidory, Ransack* etc etc.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NETWORK
You are the only hope for the whole universe.
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Control the 04 droid through 80 screens of manic action.
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Three superb games, from one of the top BBC programmers, don't miss this.
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Hints 'n' Tips

Kourtyard revealed

From the game's author Mark Rogers comes details on how to cheat in this superb arcade adventure.

Firstly, the in-built cheat mode! Press <Shift> and £ together when the status screen is displayed and you should get the message 'cheat' in the bottom left of the screen. In this mode the function keys have various effects: f0 – load next level; f1 – infinite arrows; f2 – infiite arrows; f3 – turn off baddies; f4 – practice bonus screen.

When cheat mode is on you're not affected by trap doors, wishing wells, cauldrons, etc.

The bonus screen gives you the chance to joust with a straw bag. Use keys a, z for the top (side view) jousting pole and *, ? for the bottom (plan view) pole. Position both poles so as to strike the two straw bags at the opposite sides of the screen – not as easy as it sounds!

Remember when playing that you only have 99 energy units and these are depleted by five units whenever you make contact with harmful objects, such as pots of boiling oil, spikes, moats, etc. Remember that if you keep walking into them, then you'll keep losing energy – practice negotiating clusters of these.

When designing your own screens with the editor, remember that your character always starts in the top left hand corner of the screen. Each level is 64 times 64 landscape blocks in size, or a map size 66 times the size of the screen.

There are some undocumented features in the editor. Firstly, type M, C, R when the title screen is displayed for a secret message! Keys 0-4 will set the safe trap dopr direction – eg 4 sets North to South. And f0 and f1 sets the cannon flag off and on respectively – this tells the computer whether to fire cannon balls from block F and it's set to on for levels 2 and 3.

Ransack

Author Peter Scott writes to let Arcade readers off the hook with this great zapper. Firstly, the cheat mode! To get infinite lives (about 230, in fact) enter **RAMALAMA-DINGDONG** on the high score table. ▶

*LOADing soon

A fair bit of news for a change, with software companies beginning to plan – firstly for the May show and, more importantly, for Autumn and the PCW Show – this year in Earls Court.

● Go-dax plans move ahead as before. Next up should be *Cyboto*, already previewed in these pages, followed by Delos D.Harriman's multi-Beeb game *Bolo*, which should see up to 16 players challenging others for control of an island. After that, things are a little unclear but Philip *Despatch Rider* Whitehurst is coding a 'kind of *Space Harrier*, sort of', Gary ('no, I'm not Gary Partis') Pennington is doing 'great technical stuff' and there is a faint whisper on the wind of *Out Run*. Oh, yes – look for Archie goodies in the Autumn too.

● At the budget Top Ten, we have this issue's preview *Gridiron* out already, together (at last!) with the *Peter Scott Trilogy*. Following in May is *Kwantung*, which you'll recall was an Arcade reader submission. After that – who knows? Top Ten are eager for Beeb games to release so get in touch with any proto masterpieces.

● Down the road (sort of) at Audiogenic we have an apology about the mix-up about *Kourtyard* (now *Pipeline* from Superior), encouraging news about the near legendary *Daxis*, which has now metamorphised into a 'very advanced, arcade adventure shoot 'em up' which seems to cover all the bases and some more tentative plans. Such as another sideways scrolling game for Summer release which is 'a bit reminiscent of *Ghosts & Goblins*' which, in the immortal words of MD Peter Calver is 'great precisely because it doesn't look like a BBC game!', an arcade adventure/*Pengo* cross that is similar to *Solomon's Key <RI(no, I can't picture that either!) and, depending on the hardware sales, Impact* for the Archie.

● Watch out for a review in our education pages of Squirrelsoft's *TV Director*, which is claimed to be part education/part game.

● Micro User's parent company Database's joint venture software house is now called Mandarin – first release was the Powerhouse Software game *Icarus* - reviewed here first!

● Tynesoft's *Summer Olympiad* should have a Seoul trip as prize – note the frozen face of James Herkess, winner of the *Winter Olympiad* competition in Calgary.

That's about all Superior will commit themselves to, but the Summer onwards should see: the boxing simulation *By Fair Means or Foul*, *One Night in Bangkok*, possibly *Thrust II* and *'3DM'* and, even later, the eagerly awaited *Elite II* (although Dave Braben is pretty busy with *Zarch* conversions – did I hear you ask: when is the Beeb version? Patience, patience – plus more coding for Superior and others) and *'Haunted House'*. In there somewhere is a license tie-in with Cadbury called *Zorbicos*, or similar.

● Discovery from CRL has now vanished into the mists.

● Martech have a wee surprise for us – look out for *Mega Apocalypse* NOW

Meanwhile three big US arcade conversions are being coded form the PCW Show and *Leaderboard*, the golfing simulation, is expected now from Kevin Blake.

● CDS continue to plan a full schedule. Quite why this software house never gets much attention is a mystery to me, but hopefully May's release of *Colossus Bridge* will change that, although sadly both *Colossus Mah Jong* and *Colossus Roulette* have been put back. The budget Blue Ribbon line loses *Dominoes* but Birdie Barrage, Golf and *Darts* should be out now. Sales Director Martyn Wilson talks a lot of sense about the industry and I share his belief that there's room for 'the easy to play pocket money game, that doesn't demand state of the art skills'. Keep him in beer and seek out the titles!

● A deep breath before we leap into the ever-deepening lake of Superior/Acornsoft projected releases! Firstly, we have *Spy Cat*, a 100 screen, interactive expose of M.I.4½ coded by 'Dylan' and the Archie tank simulation *Conqueror*. Next up is the superb *Pipeline*, previewed in these pages as *Kourtyard* and *Exile*, a landscape scrolling arcade adventure by Jeremy *Thrust* Smith and Peter Irving. It apparently has superb animation of the main character and will be another big package with manual, etc.

● Following on from the success of *Star Wars* from Domark plans are afoot for *Empire Strikes Back* in August. Stay tuned for more details.

● Grand Slam are living up to their name with a hat trick of super games; one for the Beeb- *Pac Land*, and two for the Arc- *Terramex* (already a smash on the Amiga) and *The Hunt for Red October*. They're also looking for Beeb programmers, if you want in then call 01-439 0666.

● Cross *Krypton Factor* off you list of future releases. No Beeb version now planned (Sob!)

● What else? Wait and see although completists might like to check out the new Pet Shop Boys album which has a track co-written by 'Orlando' – can it be?

▶ Try pressing CTRL/f4 when the tune is playing on the title page or high score table – you should hear a peep. This should advance you a level each time you play.

Atic Atac

An old game now certainly, but that old Ultimate magic lives on. If you're still stuck here's a complete solution (note l=left, r=right, u=up, d=down):

Down left, pick up green key, l, l, l, l, u, u, u, u, r, r, fall and pick golden key, down right, d r, r, r, d, d, r through bookcase, u, through bookcase, get letter, through bookcase, d, through bookcase, d, through bookcase, l, u, u, l, l, l, d, l u, u, r, d, l, d, l, l, d l, get, r u, r, r, u, u, u, r, d, l, l, d, d, get handle, u, u, r, r, u r to finish.

Impact

K.Cookson send some quick advice for *Impact* – press <Ctrl>, W, f0 and f1 simultaneously then RET for a cheat mode. When playing, 'G' should get you any token and 'J' a jump to next screen.

Quickies

Some quickies but goodies from Tje Fantoon (!). Firstly, for infinite lives in *Gorf*: Load "GORF", enter P%=$3CDE:[NOP:NOP:] and then RUN.

For infinite lives in *Dambusters*: *LOAD DAM2 and enter P%=&162B:[NOP:NOP:] and CALL&15D0.

Lastly, for *Gisburne's Castle*: *LOAD CASTLE and then, for infinite energy, enter P%=&483B:[NOP:NOP:] or, for infinite arrows, enter P%=&3B22:[NOP:NOP:] and CALL &6690.

Repoball Diary

John Mackay is putting the finishing touches to the game, so we've decided to hold back the final installment of the Diary until next month when I'll review it **Exclusively** (can you stand the suspense?).

● Finally, it looks as if Impact Posters may well be releasing some games related discs as well as offering mail order and a small magazine with advanced news, tips, etc. Trying to do me out of a job, fellas?

Competition revealed

A couple of issues back we celebrated Supasoft's 10 year anniversary by asking which was the only Beeb game it released. Response from Arcade readers has been amazing apparently and now, under the Audiogenic label, there are tentative plans to rerelease the game – *Qix*, of course!

Strange but true!

Take a moment and think about the most expensive game for the Beeb you might have bought.

Okay? Well, I suppose you'll have picked Firebird's *Sentinel*, or Micro Power's *Dr Who & the Mines of Power* or, most likely, *Elite* from Superior/Acornsoft.

You'd be wrong although, until a day or two ago I'd have agreed with you, although I might have added the Superior/Cumana release of *Star Striker* on Astron card because of the need to buy the hardware as well. No, the most expensive Beeb game I can trace was available in 1983 from Superior – at just £49.90.

What? That was, you'll recall, about an eighth of the price of a Beeb so what on earth could have cost so much? Just a disc compilation offered mail order containing six classics – *Centipede, Space Fighter, Fruit Machine, Galaxians, Invaders* and *Alien Drop-out* together with a 'special menu-type selection program'.

Did anyone out there buy one? Do write and let me know.

And the cheapest? Well, probably the 50 games on one cassette that Cascade used to offer, although that was a real embarrassment!

And Finally...

And finally, another month slips by and we reach the end of the column far too quickly.

As ever, I await your comments, your tips, your maps and your pokes – via **Micronet mbx 919999020** or by post to: **Dave Reeder, The Arcade, A&B Computing, ASP Ltd, 1 Golden Square,London W1R 3AB.**

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Darrin Williamson

NUTS AND BOLTS MIDI

The recently released DX11, a multi-timbral synth and full function keyboard for £599.

MIDI is a term used a bit too much these days. It's become the 80's buzzword for small but perfectly formed pieces of electrical hardware (eg Midi Hi-Fi). MIDI does have another meaning in musical circles in which it represents a musical processing protocol for the majority of electronic musical instruments currently under manufacture.

What is MIDI?

MIDI stands for Musical Instrument Digital Interface and represents an astonishing achievement in consumer electronics. Not for any technical reason but purely because it's one of the few instances in history when Japanese, European and American electronics manufacturers have sat down and agreed to a single set of standards which everyone conforms to (pretty remarkable, I trust you'll agree!). So MIDI is actually a two part concept; Firstly it is a communications language and secondly an interface which interprets and converts the codes into musical output.

The MIDI concept

The MIDI protocol consists of 16 independent channels which work a little bit like a C.B. radio. Stay with me, I'll explain. A MIDI interface transmits information about what note or notes have been hit and what characteristics (duration, velocity, volume etc) these notes have. This data can then be sent to any or all of the 16 MIDI channels, rather like a CBer talking on a specific radio frequency.

Therefore you can route say, a bass line to a specific sound unit by setting your input device to transmit on, for instance channel 10 and set the device you wish to respond to the same channel. Then only one device will "play" the bass line. If, however you wanted to send one musical phrase to a whole multitude of synths then you can either set all your output devices to the same recieve channel or set your input device to transmit on all channels (AKA "Omni mode").

This may sound a bit complicated but it's just the same principle as if you had linked together two BBCs with a comms package. Hitting a letter A on one micro would reproduce the same letter on the recieving machine. It's not the actual letter that has travelled down the RS423 lead but and ASCII number that represents that letter which both machines understand. Likewise with MIDI, if you link two synths together in much the same way playing middle C on one will result in the other responding with the same note. Again the sound hasn't been transferred but a numerical representation (in this instant E60) of it that anything MIDI equipped will interpret correctly.

Getting into MIDI

So what basics do you need for MIDI? Firstly you need something to generate the codes. The obvious choice is some form of synthesiser as this will not only give you the keyboard input you require but access to some playback sounds when the composition is complete. When choosing a synth you really need one with as many performance controls on it as possible (eg pitchbend, modulation, after touch etc), and some form of touch sensitivity as most sequencers accept sensitivity and performance data as do most sound modules these days. Ideally the synth should also be equipped with MIDI mode 4, otherwise known as "mono mode". This allows you to assign a different sound to a different MIDI channel thus giving the illusion of having up to 16 synths depending on how polyphonic the keyboard is, eg if the synth is eight voice polyphonic (eight notes can sound at the same time) so if you assign a separate sound to a separate channel the maximum number of sounds you will be able to extract from that machine is eight. The most cost effective synths around come from Casio. Most economic is the *CZ-101* which now retails for around £200 (provided you shop around).

Alternatively you could opt for a MIDI master keyboard, which has all the perfor-

mance features of a top of the range synth without the voices. You may be wondering what the point of that would be. It depends on how complex your set-up is likely to be. If, for instance your system is likely to consist of several sound modules (keyboardless synths) then you will be able to control each module more efficently as most master keyboards allow you to route different MIDI channel and map them onto different areas of the keyboard, for instance you could split the keyboard so that the bottom octave was sent to a synth running a bass sound, the middle two octave driving a strings sound on a different MIDI channel to a different module and so on. Once your keyboard split points are configured the way you want them you can then store the whole thing as a memory patch that can be recalled at a later date.

As with synthesisers you can spend virtally any amount of money on a mother keyboard. The best value range in this catagory comes from Cheetah Marketing (best known for producing add-ons for a certain rubbery keyed micro), prices start from £200 for the basic model rising to to £400 for the seven octave, touch sensitive, weighted keys and three programmable split points. Personally I would recommend the mid-priced model in the range, the *MK5V* which offers five octaves of touch sensitive keys and both pitch bend and modulation wheels. This model goes for about £275.

All well and good if you know your way around the ivories but that's of no use if you play something else instead. Fortunately there are also a number of alternatives in the shape of MIDI equipped guitars (from Roland and Casio), basses (from Roland), drum pads (from *Roland, Casio, Yamaha and Simmons*) and wind instruments (from *Akai and Yamaha*). There are even units that take a vocal input and convert them into MIDI codes. *Syco Systems* have developed a pitch tracker although you will be looking at pay thousands rather than hundreds for one of those. More within the price bracket of us mere mortals is the *Korg Voice Processor* which is the MIDI equivalent of a Vocoder which allows you to talk or sing through notes played from a MIDI sound source which can produce some interesting effects, although it is unlikely that the vocal part will actually be recorded as modified MIDI data.

As you can see the use of MIDI in music composition allows a great deal of flexibility for both the serious musician and hobby computerist alike.

The Casio DZ-1 MIDI Drum Pads, at £179 they're hard to "beat".

Still the most cost-effective entry into the world of MIDI synthesisers – the CZ-101.

Let's play Master and Servant with the Cheetah MK5V Master Keyboard.

U-CONNECT

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U-Connect is ideal for the Archimedes User who wishes to connect to remote computer services, such as Bulletin Boards, Online Databases, Conference Systems, E-Mail systems etc. It is supplied on 3.5" disk, with a comprehensive user manual covering all aspects of the package.

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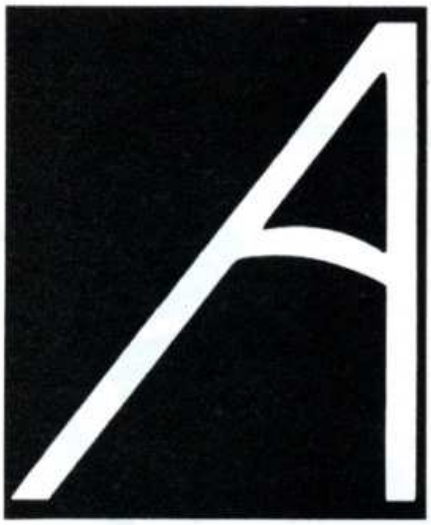

Archimedes Disc Magazine

Red Keys Issue One

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Red Keys Issue Two

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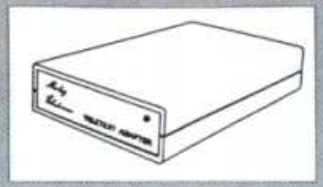

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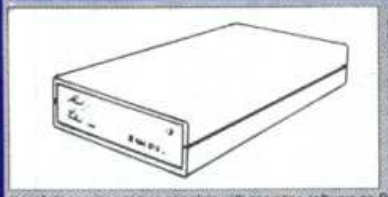

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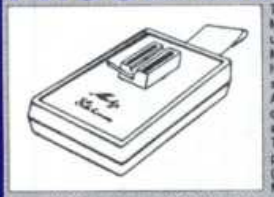

The MORLEY EPROM PROGRAMMER V2 is a small self contained unit that plugs into the BBC or MASTER user port. It comes with a high quality ZIF (zero insertion force socket) and contrasting plastic case. Also included in the package is it's own user friendly menu driven software on ROM or disc.
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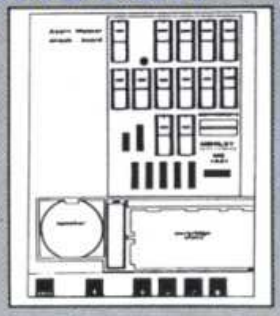

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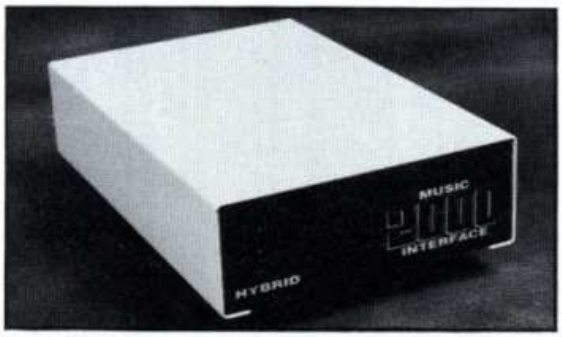
Clive Grace

AMPLE GOES MIDI



Back in 1986 I reviewed a prototype of the Hybrid Music 200 interface for the older AMPLE BCE version of the language, it was good then, so good that I recorded long sections of music using it, and subsequently released it on a music tape called *Music From Numbers*.

After a complete redesign of the software, and some minor rejigging of the hardware in order to overcome a problem inherent in the Master series, the Music 5000 was released, this time by Hybrid Technology, the designers of the original system before it was bought up by Acorn and rebadged; The software boasted multitasking real-time and step-time recording, a fully blown language facility, studio like facilities for panning, mixing down, waveform modification and even screen designing facilities.

AMPLE input (and output)

AMPLE – as you may, or may not know stands for **A**dvanced **M**usic **P**roduction **L**anguage **E**nvironment, and it was designed to be independent of its musical output, so the music control facilities, including all of those on the studio 5000 disk (staff editor, Recorder – and all AMPLE Nucleus words) operate equally on the music 5000 *and* the Music 2000. The way the software has been designed means that any signal sent to the Music 5000 can also be sent to the Music 2000 and therefore sent to a synthesiser supporting a MIDI interface.

This is, as AMPLE users may imagine, an extremely powerful facility, and it is something I have not yet seen in an integrated music system such as Music 5000, let alone the ability to control its own synthesised sounds *and* send MIDI information at the same time!

The hardware unit is essentially a MIDI interface, it is housed in the same beige boxes as the Music 5000 synthesiser, and its counterpart amplifier, so they will stack on top of each other thus keeping a very small footprint on the desk, it is reasonably well shielded (an important factor when using any electronic equipment in a studio), and it poses no great power drain.

Hybrid's Music System is extended to accept MIDI – opening the doorway to professional digital recording

The documentation is excellent – it is the usual A5 spiral bound tome with a clear printout and it is cleverly sectioned into two halves, the first half being an introduction to MIDI (as the Music 2000 may be the user's first experience of MIDI this seems a good idea), whilst the second half can be seen as the reference manual for the software – which you will find important to learn for programming music with MIDI later on.

Playing Voices

At the heart of every basic not playing function of the Music 5000 is the voice; MIDI compatible instruments allow their voices to be controlled by the Music 2000 interface by using the MIDI In socket on the instrument, so you plug in a keyboard or a synthesiser module directly into the Music 2000. AMPLE then lets you direct any voice or part of a piece to be performed on the intruments voice(s).

Assuming you have correctly installed your backup copy of the software, you enter the system by pressing <Shift> and <Break> and this will load in the new menu showing the extra Music 2000 facilities.

Now you are in the heart of a programming environment that really has to be used to be believed, with a synthesiser plugged into the OUT 1 socket on the back of the Music 2000 you can now send musical data to the synthesiser as if it were just another voice on the Music 5000.

For example, the most basic thing you can do with the new software and hardware is to type:

READY 1 VOICES MIDIV
ABCDEFG △

This will (as you can probably guess) will prime the MIDI channel ready for some signals, use a single voice to send a simple sequence of notes up the cable, flashing the red LED on the Music 2000 interface as it does.

You can even control your synthesiser from the comfort of your Music 4000 keyboard – it isn't a MIDI keyboard *per se*, but once fitted to the Studio 5000 environment and the Music 2000 interface, it can intercept your keyboard input by simply typing in:

3 SHARE MIDIV

Now this is all well and good, but the Music 2000 interface can do a lot more than just that., you can send more than one part to the same MIDI instrument provided they do not overlap (ie, they stay in their own relative pitch ranges), by typing in

3 SHARE MIDIV 4 SHARE MIDIV

you should be sending split keyboard information – if your keyboard can handle it.

Adding to the system

So in order to permanently add MIDI voices to a piece of music, so that they are used automatically and with no pre-typing or setting up, all you have to do is use a separate mix – this has been expanded to fit the new word "mix9", it doesn't affect the Music 5000 voices but it does allow you to control all of your defined voices on your synthesiser setup as MIDI triggered information.

This is a very useful facility and it means that from now on, I, and no doubt a great many other people, will be writing MIDI scores to run alongside Music 5000 scores taking advantage of the synthesiser facilities where and when fitted.

This does however mean that people supplying MIDI music will have to supply suitable details of their particular MIDI setup,

after all, there would be no point in setting up a MIDI signal for on person's DX-21 and throwing it down the line to a MIDI drum machine would there?

Stored Instrument Sounds

The stored sounds on a synthesiser are referred to as "programs"; they can be selected using the instrument's front panel controls ore, as is more likely, by using a word in AMPLE to do this when, and where you like.

By typing in

3 SHARE 0 MIDIPROGRAM

As a piece of music is running, you will hear the program on the synthesiser change, and set itself to 0, unless it was already 0 – on a couple of instances, the synthesiser did not set the program to 0, and this is because some manufacturers do not comply with MIDI's numbering scheme, but on the whole, most modern MIDI instruments do select the proper numbering system – if your doesn't, then don't worry as you can reconfigure your system any time to suit a different machine.

By altering the Mix9 word (written, as most commands are, in AMPLE), then you can easily have this set up inside your music.

On the Staff...

All music created on the Music 5000 in standard AMPLE notation are reproduced by MIDI voices – apart from slurred notes (which the 5000 caters for). If you have a "velocity sensitive" keyboard, then you will be able to send *forte* and*Piano* information, if you don't, then MIDI will ignore these as well – all aspects of MIDI's note information are accepted via MIDI though.

MIDI's dynamic level can go as far as 127, on the Music 5000, this is 64, so if your music sets the system value "=L" to 64 and it is chanelled off to a velocity sensitive synthesiser, then it will come out quieter than normal.

Writing music on the staff has been the most used part of the AMPLE environment for me, although I know of musicians that swear by the real time input facilities – the staff is, to all intents and purposes, MIDI compatible – apart from the facilities not supported by MIDI (that are ignored anyway).

What you cannot do is send two MIDI notes as a unison (the same pitch), since this is impossible to achieve on a keyboard, it is hardly fair to expect this of a computer is it? Some MIDI keyboards accept unisons nowadays, but the selection of notes is entirely arbitrary, to use an example, the chord C(EG) and E(FB) can give rise to some unexpected results leading to parallel beats which are something the writer did not ask for. You can get around this by altering the structure of the chord so that instead of E being at the root of the triad, we have F instead.

Naturally the more instruments you plug into your MIDI network, the more sounds and timbres can be created, you can, for example set up a second synthesiser to copy everything the first instrument plays – something I have done in order to beef up certain Roland string sounds, but why stop at just copy another instrument, why not write a complete score for a second instrument?

There are three MIDI sockets on the back of the Music 2000 interface, this doesn't mean that you can only plug in three instruments, by judiciously using the MIDI "through" sockets, and after programming your synthesiser so receive only information on a separate MIDI channel (let's say MIDI channel 5), *only* the music sent along channel 5 will be played by that particular instrument.

After a while, your music will start to rely on the logistics of a local area network, after all, that is what MIDI is all about, sending information to different terminals, it is just that with MIDI the information is musical, and the terminals are instruments.

Incorporating The Hardware Into Your Studio

When I say studio, I don't just mean professional multitrack studios, I am also talking about the many bedroom setups that, to all intents and purposes serve just as good a purpose as we are recording digital information.

Any of the Music 2000's output lines may be used for a drum machine, but it is conventional to use OUT 3 leaving OUT 1 and OUT 2 for conventional instruments. Using this means that you will not come across timing errors on the drum machine due to a loaded MIDI signal. In time, you will begin to detect the slight wavering of triggered signals due to the fact that the MIDI information is having to be taken in, absorbed and passed onto other MIDI instruments along the chain. There are ways around this, by putting programs with longer attack envelopes to the back of the stream, thus negating most of the timing errors that can occur with all large MIDI networks.

The Music 2000 interface is controlled completely from within AMPLE, this not only means that you can use it as a substitute for the Music 5000 synthesiser, and as an alternative sound source for your music, but is also means that you can program MIDI itself, thus giving you full access to the synthesiser's hardware and software, often enhancing the facilities of your synthesiser.

AMPLE can support and talk in system exclusive modes, so if you have a synthesiser that you wish to access certain system exclusive items and effects – this "should be" a standard message header and a series of bytes, but some synthesisers do not allow proper access, this doesn't matter to the AMPLE user as the environment allows access to the system exclusive dump facilities and so on, the language is there, so I expect we will see a whole host of system exclusive programs for individual synthesisers in the near future – hopefully these will become available through AMPLINEX or Music City or some such similar service.

Programming Words

There have been a number of additions to the environment – studio 5000 is now release 2, hence the suffix 5000-2. Thirteen words have been added in all and they are as follows:

Gate sets the gate of the current voice to ON or OFF, it controls the sound output of the sound-playing voice, so ON GATE will make the voice sound, whereas OFF GATE will send a rest to the unit.

This is also used to reset musical events so that you can have direct control over voices for special effects.

Pitch sets the pitch of the current voice or voices in semitone units, as before 0 is middle C, negative numbers being lower and anything above 0 being higher.

Vel sets the dynamic level of the current voice or voices, this is essentially a software controlled volume knob *but reacting only to velocity sensitive synthesisers*, it is not an amplitude control.

MIDIBEND sets the amount by which the note pitch is bent above or below the normal pitch by sending a pitch bend setting on the channel of the current voice, this is set up so at to communicate with the pitch bend wheel fitted on many synthesisers and varies between semitone levels – you can set it up so as to vary between not values (so the pitch bend changes between notes C and D for example), and most pitch benders allow only a 12 semitone pitch bend for glissando effects.

MIDICHANNEL as described earlier, sets the MIDI channel number to be used by your currently selected voices. It can be set to any number between 1 and 16, thereby gaining access to all MIDI channels – this does not affect the performance of the Music 5000 synthesiser.

MIDICHPRESSURE sets the amount of key-pressure effect to be applied to all notes on the voices channel, this is set from 0 to 127 (maximum pressure).

This is basically intended to inform the system as to how much pressure is to be applied to the keys of a keyboard, it's effect relies solely on the receiver.

MIDICONTROL sends a control change message to set the numbered control to the given value (position). It provides computer control over the effective positions of the instrument's panel and internal controls, and also the instrument's MIDI reception modes.

MIDILINE sets the output line for MIDI output, it is used to direct control to the various different MIDI instruments when they are connected to different MIDI output lines.

MIDIOUT sends a signal to the MIDI output line of the current voice – there is a companion word called MIDIWOUT, which sends the byte stream as pairs of bytes.

MIDIPRESSURE sets the amount of key pressure applied to the note on the current voice – this can be set from 0 to 127.

Using Music 2000 with MIDI

I literally had this unit up and running minutes after the hardware arrived. Once incorporated into your music making setup, the Hybrid Music system soon becomes the core of your writing system, it quickly ousted The Deluxe Music construction set on my Amiga – before the arrival of the Hybrid system, my Amiga system was beginning to take centre place as *the* composition system with MIDI.

Now that AMPLE has MIDI compatibility (above and beyond the prototype version – which was functionally completely different), there is no reason why the Music 5000 cannot be used in a professionally sequenced environment. It has the quality sounds it always deserved back in the days of the Music 500, it is easily programmable, it is all interactive, and it has all, if not more of the composition options available to packages from Steinberg Research costing £500 odd pounds running on a £700 computer system with an eighth of the memory of an ST running Steinberg's software.

The MIDI interface is very good; there hardware is built to a high standard and it plugs into the back of the 1MHz bus socket leaving another port for a future expansion – this does not have to be a music device, it could be a teletext adapter or a digitizer – provided they use the 1MHz bust protocols properly, all of the devices will work together harmoniously.

From the point of view of a Music 5000 owner wanting something a bit better than just eight voices, and wanting to explore MIDI I couldn't recommend a better system, it has integrated into the system very well, and that people can now start writing music to take advantage of their synthesisers without having to move out of the comfortable environment of the Studio 5000 can only be a good thing.

For people wanting to get out of the environment and get their hands dirty programming sequences, MIDI operations and generally do the things that were impossible before AMPLE will be an ideal language to learn.

MIDI system exclusive dumps will no doubt be with us soon, as will hordes of MIDI utilities, expansion modules and other items of general interest.

A Particularly Good Synth

If you are looking for a very good synthesiser for use with the Music 5000-2 system, have a look at the **Roland MT-32** synthesiser, everyone is raving about this neat piece of equipment because it has one of the most complete MIDI implementations, 127 built in sounds (and downloadable ones too) and these sounds are very good indeed.

Without showing favouritism, I plugged a Yamaha DX-21 into the interface, whilst it's performance wasn't too brilliant as an instrument, its use as a MIDI sound generator was more than adequate, the older keyboards, such as the Siel DK 80 and DK 600 performed well, albeit simply as note on/note off for the DX600, velocity sensitivity proved well on the DK 80 and the MT-32.

For the professional, Music 2000 has a lot to offer – because it does not have the WIMP environment that some professional musicians have come to associate with "quality" (they've got to have something to do with the other hand), then I think it will be more of a case of seeing for themselves just how good Music 2000 is.

Having used a great many professional systems in the past, Music 2000 ranks as the very highest because it is integrated and is overall, a considered and well thought out product.

Factfile

Contact Hybrid Technology Ltd, Unit 3, Robert Davies Court, Nuffield Road, Cambridge, CB4 1TP. ☎ 0223 316910.

In addition to editing A&B Computing, Clive Grace has been using AMPLE since its first release. He has been programming MIDI instruments for the past five years and has written two commercial albums and some incidental music.

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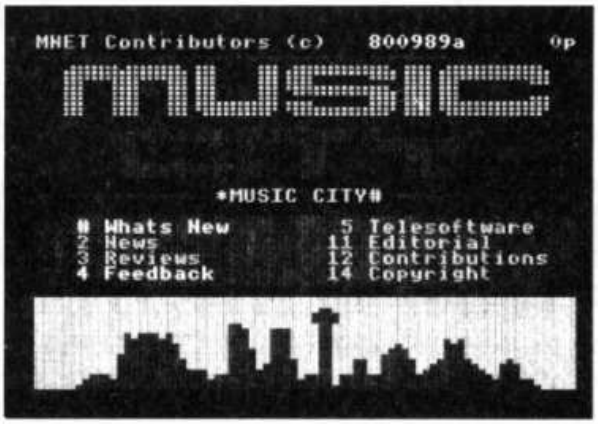

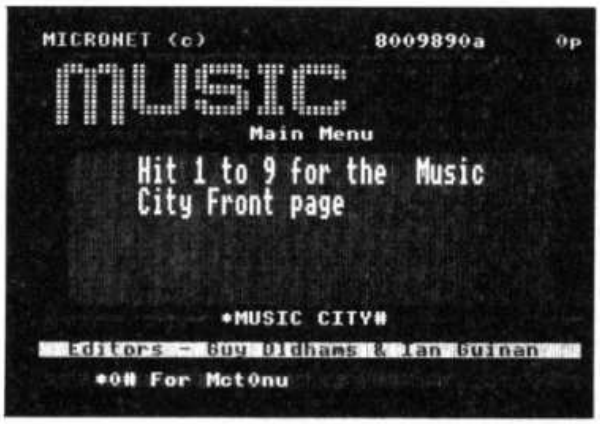
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*MUSIC CITY#
Editors – Guy Oldhams & Ian Guinan
*0# For Mct0nu

The long-awaited return of a Music Microbase took place late in 1987 with the arrival of Music City. It is accessible to anyone with a modem who subscribes to Micronet, Prestel's most popular Database.

Music City opened their lines with downloadable software for the Hybrid Music System (Music 5000 – Ed.) Support for Hybrid's Music 5000 and 500 was – and is – their first priority and feature articles on the System are planned. The list of downloadable software, however, is expanding rapidly and includes music which will run directly on the BBC and other computers.

They hope to be able to offer Amiga samples – this will be the first Amiga software for Micronet – although the sheer size of the data could cause problems. They also intend to include Atari ST music and, of course, the Archimedes has not been forgotten. They already have several music files created with Archies Music Editor program.

Organised and edited by enthusiasts Guy Oldhams and Ian Guinan (many of Ian's Music 5000 pieces are already available), Music City also features reviews of music software, MIDI programs and absolutely anything and everything to do with computers and music.

Low end MIDI support

They are particularly keen to feature reviews of equipment at the lower end of the MIDI and hi tech musical instrument market – the sort of gear you and I can afford. This will include items such as budget-priced drum machines, Roland's MT-32 expander, Casio keyboards and the Cheetah range of keyboards and equipment.

News coverage will include everything connected with music and computers and being on-line they should be able to bring you news long before the monthly music magazines.

The initial response has been one of overwhelming support and encouragement. Ian and Guy are keen to hear reader's views and opinions and are actively seeking contributions. Now could be your chance to review an instrument or some software and if you've written any music – for any machine – Music City would like to hear from you. If they use it you may even receive royalty payments.

Music City have an arrangement with the MCPS (Mechanical Copyright Protection Society) whereby they can publish copyright material. A small fee is paid to the MCPS who distribute it among the authors of the works used. Now you can write a computer version of a current pop song, have it published and get paid for it. Part of the Music City software download charges go to the music programmers. Get writing!

You can log onto Music City from Micronet's Microbase section. They have no keyword as yet but one should be forthcoming soon and may be available by the time you read this.

Factfile

More details from *Music City, 138 Prescot Road, Aughton, Ormskirk, Lancs, L39 4SW.*

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Clive Grace

RETURN TO UMI

A few years ago, I reviewed a promising new MIDI composition package for the BBC Micro; Called the UMI 2B, it was a real time MIDI recorder with additional step time facilities; housed inside a neat metal box (often sitting on the top of the BBC case), it was graced with a variety of MIDI ports, a CV/gate and plenty of triggering options – certainly the UMI 2B was one of the most comprehensive packages around for an 8 bit micro, let alone the BBC Micro.

Since the days of the BBC Micro, things have changed quite a bit; The arrival of new and more powerful computer systems, such as the Atari 520 ST and the Amiga have done much to change the way computer composition packages look and feel – nowadays a package need only have a WIMP interface, and it is considered a "quality product", but the fact is that a great many of these packages do not need a WIMP interface, as a result they become hopelessly cluttered (programming wise, and operationally), and the computer system is dramatically slower because it has to look after the extra graphics facilities of a package supporting WIMPs.

There is also the one universal truth to computer programming, *"The program expands to fit the available space"*, and with such complex packages such as Steinberg's Pro-Music system (for the Atari ST) and The Deluxe Music Construction Set (for the Amiga), it is not surprising to find out that these packages stuff up the machines memory to the full.

The UMI MIDI composing system has been revamped, improved and generally beefed up — how does it compete against the giants from Atari and Commodore-Amiga?

Introducing UMI

Not that UMI is any different, but what it achieves in a 32K machine, I have yet to see in a 512K Amiga system regardless of what is achieved through the use of WIMPs.

First things first, UMI *has* changed dramatically from the UMI 2B; back then it supported Shadow RAM, it had a bewildering number of inputs, the manual was a bit grotty (albeit readable .and in good plain English – which was more than could be said for "the competition") and it had the useful ability to save DX-7 saved sounds – similar packages are costly in their own right, back then the DX-7 was the archetypal MIDI keyboard, nowadays it is just expensive.

Nowadays, the UMI 4M is a different beast, similar in some ways to the 2B, but on the whole it is faster, easier to set up, and by virtue of the new UMI's two ROM system, it is a damn sight easier to program – if you are a keyboard musician.

It has to be said now that UMI is not a package for non-keyboard MIDIyists; and now that the walls of MIDI are being broken down by the application of MIDI Guitars,

MIDI Violins (!), MIDI Clarinets and even a Piano based MIDI interface, there may be some confusion as to just how useful this package is to musicians looking for an easy way to record.

Personally, I have found that with repeated use, UMI is very easy to get on with; it is essentially a real time recording package, with the addition of the usual step time options, such as block move, loops, transposition and the like – and like the 2B, the new UMI environment makes it easy to "bash out" a more or less complete idea within a few minutes than, say, a dedicated sequencer, but I have met professionals who wouldn't even dream of coding their music into a computer, creating some stunning results using a dedicated sequencer system – it really is a case of "you pays your money and you takes your choice".

Looking around UMI

UMI *has* changed, it is not a simple re-release of an old software package; the body and soul of the 4M has been transformed into something quite different, yet retaining compatibility (and file interchangability) with the 2B.

All of the usual function key options are still there, with a slight change here and there; the MIDI interface is smaller, but, ironically the software has been expanded. I would guess that the reasonably *au fait* MIDI programmer will understand this package in about 30 minutes, the beginner and non-professional will probably get to grips with this package in a couple of days – not an unreasonable length of time considering the investment.

After fitting the two ROMs in the usual way (or by loading the ROMs into sideways RAM from disc), the screen clears to display the UMI main menu screen. You can set the ROMs up so that they are not selected on power up, but in the studios I have seen UMI installed in, this is nearly always the case – if you want to start up in BASIC, you can type *UMI in order to enter the package.

For the BBC Master and the BBC B, you have access to any legal sideways RAM systems and the usual Shadow RAM boards (if fitted to the B), the B Plus has a problem of non-standard Shadow RAM addressing (the OS has an incomplete implementation) this forces the UMI software to write to *both* the Shadow RAM banks instead of one, overflowing into the other.

As UMI uses mode 7 screens all the time, the data area on a B Plus is, half that of an existing BBC B with Shadow RAM – in the BBC B Plus, the data starts to corrupt each bank thus ruining longer compositions – I would not recommend using a BBC B Plus with the UMI 4M until this problem is sorted out (and it is being worked on this very minute).

The MIDI interface plugs into the 1MHz bus port and derives its power from the User Port, thus both sockets are occupied at the same time; this isn't too much of a problem unless you are using other 1MHz Bus/User

NOTES | synth sound remarks
trk A MT-32 PIANO 1 MIDI CH 3
trk B MT-32 STRING 3 MIDI CH 4
trk C DX 7 SLAP BASS 1 CH 1
trk D CZ-101 PHASE 1 CH 5
trk E DRUMTRACKS
trk F EMULATOR II STABB 1 CH 10
trk G AKAI FX CH 16

The UMI 4M Track Assignment screen showing a typical MIDI set-up.

Port devices such as Music 5000 with a Music 4000 keyboard or an ATPL Symphony upgrade – so be careful before planning to buy this interface, you may just want to use 1MHz bus devices in the future, and if they do not have a 1MHz "through" port, then you will not be able to!

As with the old UMI 2B software, each new function can be accessed by pressing one of the function keys, but as the package is essentially menu driven, you will probably be more willing to go back to the main menu when learning to use this package.

UMI and Music

The standard DX-7 dump program has been taken out of the new UMI package, what we now have is a SysEx dump (system exclusive) which is less friendly than the original, but is able to take sounds from other synthesisers. I am not too sure about how useful this will be as a lot of the MIDI instrument manufacturers rarely agree on what the System Exclusive protocol is. There is very little chance of using this option with synthesisers other than Yamaha and some Roland synths, and like a fool I sit in hope that the giants will agree on a standard.

In all, there has been very little taken away from the software, just a lot of additions, and some of these are pretty major (for example, some of the step time functions), but a lot of the "improvements" are basically tightening up on a piece of software needing to be updated in the light of competiton from Amiga and Atari.

One difference between the older UMI 2B hardware and the smaller 4M box is power consumption, the unit doesn't get as hot as the 2B and the "big button" is now replaced by the space bar in the 4M software), there are a few non-standard connections, a dropping of the jack plug connectors in favour of modified MIDI leads and a much smaller case and faster response time all add up major improvements on the hardware front.

Using the UMI system it is possible to save on one of the four MIDI outputs by wiring up your drum machine to the Clock/Sync in connector – all drum machines with professional connections accept Clock Out, so by setting up the Clock/Sync in on the interface – you will be able to trigger UMI or the drum machine by simply sending a pulse – be warned though, I had plenty of trouble with the SCI Drum Tracks machine losing its grip and going out of sync, but on the whole, this method proved faultless – with my gear.

Drum machines can be connected (more effectively) by using the other ports supplied – if your drum machine supports the Sync-24 or the MIDI options.

In fact, UMI is so good at connecting to the outside world, it is sometimes useful to record the UMI-4M's sync code directly to tape. This is very useful if, like me, you prefer using smaller studios with only a very limited track width (no more than 16 tracks) concentrating on high quality outboard effects.

By using a sync code from the UMI-4M you have effectively saved yourself eight tracks of music because you can trigger your eight synths off of one tape track all at the same time, submixing them down into two live tracks at mix down. Because you have stored away your music using UMI it may be advantageous to use a well supported eight track studio instead of a poorly equipped 16 track, or even an expensive 32 track studio – buying a UMI system costs about three hours in a professional 32 track studio – that sort of time can be saved by writing all your music in the comfort of your own home before committing yourself to the expensive studio time demanded from good studios.

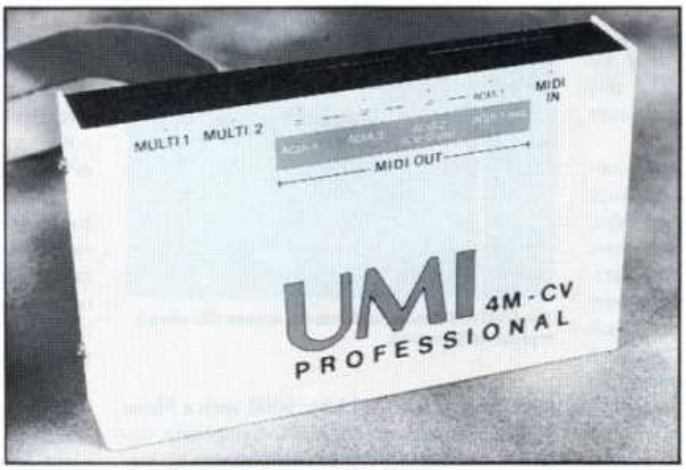
Plug in and go

There are a number of options on the main panel for the user to access; most of these options are set at certain default levels, and if you should need to change them, then it is often a good idea to have a dummy file with your special defaults already set up. I am, of course, talking about external clock settings, MIDI clock out and whether or not you want a one bar count in (using the BBC's internal loudspeaker)

The latter facility was never my most used option, but when my Drum Tracks broke down during testing (the stupid ACIA blew out on me thanks to a weird retrofitted Prophet five!), I had to compose some work using the UMI and the rest of my gear – needless to say I have been used to this type of time keeping using Ample Nucleus and the Studio 5000 software and found it useful there, but it is no replacement for a good drum machine hooked up to the UMI system, especially if you are flitting around strange rhythms from 8/8 to 6/8 to 9/8 as some folk music is wont to do.

A useful facility is the *restart note* option; If, during the record phase of a real-time session, you hit a bum note, or if you simply want to have another go, hitting the restart note on the synth will stop recording and immediately prime the system for a re-record, by using this facility with the auto start mode, this means that the real time record facility may be achieved entirely at the synthesiser console – a very advanced feature for a software package, and is a useful facility if you are using a keyboard controller away from the computer.

A very useful facility, not on the original system, is the *Help* option. This is a special disc-supported system whereby you have a



Not only does it do a good job of Music Composition but it is also an exceptionally well made piece of hardware.

disc file loaded upon every <Esc> key pressed – obviously you may not want to have this facility active when you are used to the package, but for a beginner, this is a very useful facility – I think this is a first for an interactive help system to be built *into* a MIDI composing system.

Step Time Recording . . .

Using the step time system, UMI becomes almost a music composition language with all of the features this entails. A step time language is probably the only way you are going to make sure your music is absolutely note-for-note perfect, and for many requirements, it may be easier to program music using this part of the system instead of repeatedly messing up and harrowing over some bizarre passage that defies all attempts at playing – perhaps a Frank Zappa-esque creation!

Step time recording will be either your most used, or least used UMI 4M facility, so if you have little or no keyboard skills, this may be your back door into the world of MIDI.

An **Override Channel** option exists so that the UMI system can ignore the transmitting MIDI signal on your synthesiser and substitute the signal with any other MIDI signal you care to select – this is a bit like the MIDI based patch bays existing in decent MIDI set ups.

MIDI rigs tend to have a central controlling keyboard – perhaps a dedicated controller with no synthesiser facilities at all! Using this facility, you can use the overide channel option to create many routes to a particular synthesiser – especially if you are using a series of sound generating modules or sound samplers (or both!); this is very good for making sense of the mass of cables that often tend to clutter up a MIDI network.

Needless to say that this facility is open to real time recording.

Cutting up music

UMI 4M is very good at storing snatches of named musical passages, so if you have a series of passages named 1 2 3 and 4 representing a verse, chorus, second verse, coda – but you have yet to create an end piece, you can easily set UMI to play through your piece of music as completely as your MIDI setup will allow thus enabling you to try out a few ideas for an end. This may not seem to be all that unusual on the surface, but the simple idea of setting up a few bars and linking them together to make a coherent piece was unheard of on a conventional computer system five years ago – it is still very difficult to build up individual passages and link them together using a 16 bit package like Deluxe Music Construction Set, and by comparison to the remarkably straightforward way UMI seems to have found for itself I can imagine UMI will have a lot of friends.

As with all MIDI composition packages worth their salt, UMI has a quantize option. Viewed by some as an editing tool, and by others as a cheat option to cut out timimg-errors this facility will find a lot of uses and applications. I tend to view the quantize option as a creative tool whereby you can play (or program) very fast sequences of notes and chop out arbitrary portions of the music by cutting up the quantums (also known as timing errors) between two notes.

This is independent of real time timing, rhythm and whatever your written score may say, so be careful when using this facility – always save your passage *before* using the quantize option or you may not like what you hear. By the way, if you have heard my cassette tape "Music from Numbers" – partly written using the UMI 2B system, the main parts of *Glasshouse* were written and then pared down using different quantums to butcher the general structure of four repeating bars – this facility is very useful should you want to delve into the intricacies of pattern based music (as I am) – popular exponents of this form are Phillip Glass and Steve Reich – it will annoy the neighbors but it is nonetheless great fun, and that is what music is all about.

If the pieces have all been written and laid out, and you have run out of memory (by using pitch modulation), the only way of reclaiming some space is to use the **Pac mod** option. Hitting <F2> will "thin out" the information required to generate the modulation effects, by pressing the "2" key, you will increase this effect until the modulation will eventually disappear.

The memory saving is exactly reflected by the byte count indicator and as a general rule, the pack operation will save memory *if* you have used modulation effects.

Using UMI 4M

I must admit that I have been using the Amiga and Deluxe Music Construction Set software in conjunction with Soundscape's pro MIDI studio software hooked up to their little eight bit sampling package – I also have an Atari 520 ST which was earmarked for using Steinberg's Pro Music software (after the thing had been bumped up to a megabyte) – but the fact is that UMI will always be better than the 16 bit packages I mention because they are far too complicated for their own good the UMI system is, by comparison, a very straightforward package.

UMI 4M is not just an upgraded version of the software, the differences between the 2B are mostly apparent when using step time mode. These facilities have been expanded – MIDI response has been improved – it must have been, as I successfully used a ten foot MIDI cable – something the UMI 2B quite rightly threw out as a bad idea.

The most amazing thing is that the UMI 4M is so easy to use, the menu display system is colourful, the software is rugged, reliable and very easy to program.

UMI 4M will not make you any better at writing music – that takes dedication and practice, UMI will make things easier to write and "get down" – it could save you an awful lot of money if you are a studio musician, and it will undoubtedly make computer music and MIDI a mite easier to get on with!

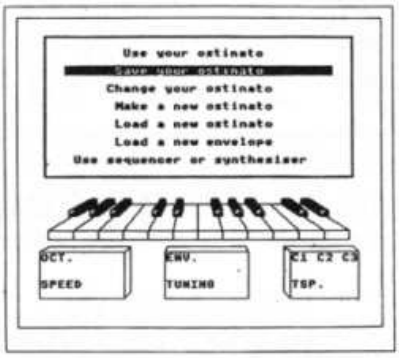
Factfile

For more information about the UMI 4M system contact *U Music, 17 Parkfields, Putney, SW15.* The UMI 4M unit costs £280 + VAT, the micro editor costs £120 plus VAT.

A slightly cheaper version of the 4M – called the UMI 3s costs £200 plus VAT, the Micro editor for this version costs £96 plus VAT.

Curriculum Material from MEDUSA

Sounds Useful



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And for the pros? The **UMI** system is used extensively in studios around the country, and with users such as Bros, Erasure's Vince Clarke (in the studio and 'live' on stage), Alan Tarney (Cliff Richard's writer/producer), Genesis' Mike Rutherford . . . their requirements are, quite naturally, for the best sequencer available. With a product in a state of continuous evolution **Umusic** can offer just that. Write or telephone for details.

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Elizabeth E Wright

PERFECT FOURTH SOFTWARE

A grades testing package

The importance of proper practicing is central to passing the RSM grades exams, the pupil has to be clearly thinking, adept at playing their chosen instrumrent, and must be prepared for the worst!

I know that may sound a little pessimistic, but this is not without foundation, after all, a pupil cannot expect to receive good marks in grades examinations unless you practice your instrument – daily. there are many practices one can do with an instrument, but there are at least as many that a pupil can do away from their instrument, and it was with great interest that I was given the complete range of Aural packages from Perfect Fourth software.

The Aural test is designed to measure the student's ability to identify and correct notes, intervals melodies and rhythms played by the examiner, this is an integral part of any grades examination, and when priming students for this part of the test, it has, in the past, been better to teach each pupil on their own for half an hour and go through these tests in a mock up simulation of the real thing – this can be quite time consuming, and arduous (especially after a long day teaching!), but there has been – as far as I know – no effective way of teaching Aural skills in the classroom for a group of children.

This package attempts to focus completely on the Aural aspects of the grades exams; this includes scale lessons, singing notes, naming notes, rhythm identification and, of course, beating time.

Grade two is a repetition of the first, but this time, the testing criterion are stricter.

These tests are designed to comply with the Associated Board of the Royal Schools of Music's grading system, and the material contained within these packages do, in fact, comply very accurately, the order in which the tests are given to the student (using the computer) are in an order, but this order is random, so there can be no memorising (something I wish I had the time to do when priming students for grades).

The grade three singing tests involve Interval singing and Melody singing, and are, as usual presented in the usual format of giving the student the option of choosing the upper or lower note, melody singing is likewise presented in a similar fashion.

Less is more

What becomes immediately apparent is the fact that the screen displays are sparse – blank even, this was a detail I queried, and was told that leaving a blank screen is intentional so as not to distract the pupil with worrying displays of staves, notes or even numbers – This I would agree with, notes flashing past at normal speed can be harrowing for a student below grade four, and Aural exams require thinking (as do all the other exams in the grades series) so to display anything other than simple graphics would be a waste of time, and quite possibly defeat the object of the software.

One very important distinction has to be made between Perfect Fourth's teaching and a more "Traditional" approach to Aural grades lessons, this is not a replacement for the teacher, there should always be a teacher present, just to keep an eye out for mistakes, so as to note them down in order to help the teacher work out what to concentrate on next lesson before the Aural exam, a nice facility would be for the program to store the marks of the pupils using the package so that names and scores *at each point in the testing cycle* are accurately noted down and then saved to disc later on.

At the higher Aural grades (grades four and five) I get the feeling that the tests are getting simpler, true enough the usual Majors and Perfects are all in line with the current standards set, but the melody singing is often too simple – five note melodies are, in my opinion, too simple and it is often a good idea to generally make them last for a couple of bars or more, certainly these tests fit the required level, but the ability to discern a melody will be needed more and more as we reach higher grades (such as grades six and seven) ultimately being used for interpretation and other skills – it gets hardest between seven and eight, whereas the difference between lower grades is more or less even.

The last package in the four box set is grade five and gives a tantalising taste of what is to come, the usual Aural tests of scale recognition and interval singing are here, but one omission that is probably more of a matter of style than anything is arpeggios – they do not form a great part of the Aural exam, but they are easily learned away from an instrument, and here is as good a place as any to test the student's understanding of them – Arpeggio theory (building up Arpeggios from formula) are certainly a good thing to learn away from the instrument, and here is the ideal frame- work within which the pupil will be responsive and, we hope, alert.

Applications in the Classroom

I have used Perfect Fourth's software in schools that have BBC Micros (most of the ones I teach in), and I must admit that by the sheer fact that there was a computer in the classroom, it tended to make pupils more attentive than usual. This attention tended to curve off with pupils of a higher grade standard to the point where grade five pupils were getting more out of simple piano/pupil tests just for the fun of using a computer, but on the whole, the programs were well received and they did tend to improve overall attention to detail – I think.

I am considering using the software in classrooms of more than five students – this is something I have never really considered effective in the past when using a piano, but with the reasonably clear music coming out of the BBC Micro's speaker, I think this will be a possibility (we will report back on this in future issues – Ed.)

All in all, Perfect Fourth's software is good reliable software, after a few weeks use, the software does tend to become a little repetitive, but then for many of my pupils, this will be the first time they will have come across the software.

Perfect Fourth's software will need a great deal of integration into your own teaching style in order to get the best use out of this software, for individual students, there are advantages, but, I suspect this will be best used for "cramming" purposes, certainly there has a lot to be said for the novelty value of using a computer in music lessons.

I personally liked this software – I have been aware of others who have not liked the software due to its sparse screen displays, but all in all, the software is reliable (it worked without fault), and It is usable within the context of music teaching in schools – especially if they already have a BBC Microcomputer.

The software costs around £15 and is available in both 5¼ inch formats and 3½ inch formats, there are higher grades in preperation, and the software is available from *Perfect Fourth Software, 11 Otters Brook, Buckingham, Bucks, MK18 7EB.* ☎ *(04427) 6311.*

Elizabeth E Wright is a local county freelance music teacher, and has been teaching Piano and Violin for twelve years.

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THE FACTS BEHIND A NEW BREED OF PERSONAL COMPUTER

The Z88 is smaller than an A4 pad, weighs less than 2lb, and measures only 7/8" thick. No other portable personal computer offers so much, in so small a package . . . and at so small a price:

JUST £239.00 PLUS VAT

Memory
The Z88 comes with 32K of RAM built in, of which around 20K is available – enough for about 2,000 words of text. This is easily expandable to 416K by simply slotting in additional RAM packs (see back cover). With the introduction of soon-to-be-released 1 Mbyte packs, total RAM of 3 Mbytes will be available – enough to hold the complete works of Shakespeare.

Keyboard and display
The Z88 has a full QWERTY keyboard with virtually silent, short-travel keys. It includes special function keys, such as ◇, □, INDEX and MENU which make it exceptionally easy for novice users to quickly find their way around the sophisticated built-in software.

The screen is a state-of-the-art supertwist LCD, which provides a massive improvement on normal displays in both contrast ratio and viewing angle – providing a clear, sharp read-out. The screen's format is 8 lines×106 characters, and provides a large working area of 8×94.

The remainder of the screen area consists of sections which hold menu details (including all the Z88's commands); a unique page map (which shows you where you are on a complete page); diary date; filing and directory details; and operating system details which give you information on the Z88's status (such as battery strength).

Software
The Z88 comes with a built-in suite of applications software, which is exceptionally capable, yet extremely easy to use.

The operating software, OZ, allows you to switch between, for example, word processing and spreadsheet applications – without the delay of loading separate disk-based software into the computer's memory. With the Z88, it's just a matter of pressing a couple of keys.

Built-in applications software includes *Pipedream*, which features word-processing, spreadsheet and database functions.

Word Processing Facilities include block marking and movement, searching and replacing, and multi-column layout. The display is fully WYSIWYG (What You See Is What You Get), showing bold, italics, underlining, centering, and dynamic page breaks as they appear on the printed page. Each page of the document is represented by a page map which shows the layout of the text.

Spreadsheet Invaluable for financial planning, this application allows you to define a series of formulae within cells (where a row and a column meet) and then to enter a series of numerical variables for manipulation. It allows profit and loss, cashflow and budgets to be quickly and easily arrived at.

Database This works on the same principle as spreadsheet – so data being stored for later retrieval is held in a known cell where it can, for example, be manipulated into ascending sequence.

Diary The Z88 diary software is a free-form log that can be configured in any way you choose, within the constraints of the Z88's memory. It's particularly useful when used with the Z88's calendar and clock to find dates and set alarms.

Popdowns include a powerful calculator, clock, calendar and alarm. A printer editor allows you to configure Z88 codes to match a wide range of printers, and to store printer definitions if you're using more than one type.

Resident programming language is BBC BASIC with assembler. Communications to the outside world are achieved using a VT52 terminal emulation mode or the Import/Export facility which allow transmission and receipt of data files between the Z88 and other PCs.

Power supply
The Z88 runs on four commonly available AA batteries, which provide around 20 hours of active computing, or a year on standby mode. Switching off puts the Z88 into standby; all data in RAM stays live, drawing minimal power from the Z88's batteries. And when the batteries need to be changed, a special capacitor (or the mains adapter) preserves the data.

CONTINUED ON LAST PAGE OF ADVERT ▶

Watford Electronics

Jessa House, 250 Lower High Street, Watford WD1 2AN, England
Tel: Watford (0923) 37774 Tlx: 8956095 Fax: 01 950 8989

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Archimedes micro

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- Entry System £679
- with Green Monitor £729
- with Colour Monitor £879

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- with Green Monitor £859
- with Colour Monitor £949

310M Series

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(Securicor carr. £10 on Micros)

Archimedes SPECIAL OFFER

FREE, £125.00 worth of Hardware

With every Archimedes Micro purchased from us, we are giving away absolutely **FREE** a 5¼", double sided disc drive with PSU, (1 Megabyte unformatted), plus the special Archimedes interface cable, worth **£125**. This package is absolutely essential if you want to run BBC software or IBM software with your Archimedes, in the emulation mode.
(P.S. This offer does not apply with 0% finance scheme mentioned in column two).

- 0.5 Mb RAM for 305 £85
- Podule Backplane £37
- ROM Podule (Computer Concepts) £46
- Archimedes Ref Manual £29
- ARM Assem. Lang Prog Manual £12
- 2nd 800K floppy disc drive (for 305, 310 & 410) £118
- Econet Network Board £40
- Backplane for 2 podules, with fan (305, 310) £39
- I/O Podule (with User port, Analogue port & 1MHz bus) £75
- MIDI add-on to I/O Podule £27
- ROM Podule (takes five 8 bit ROMs, of 16, 32, 64 or 128K) £56
- Real time Video Digitiser (Watford) £249
- Sound Sampler (Armadillo) £105
- 20 Mb Hard Disc for 300's £469

Archimedes Printer Lead £7.00
Archimedes Monitor Lead £7.50

WORDPROCESSORS

Wordwise +	£18	View	£49
Image Writer	£23	Viewspell	£32
Interword ROM	£35	ViewIndex	£12

DATABASES

AlphaBase	£39	Delta Plus	£57
Viewstore	£49		

SPREADSHEETS

Intersheet ROM	£35	Viewsheet	£49

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GammaPlot	£30	Interchart ROM	£22

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(for 310, 410 & 440), including MSDOS 3.21 £89

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Interchart	£25	Gamma Plot	£30
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LANGUAGES

ANSI 'C'; ISO-PASCAL; FORTRAN 77; £95 each
Cambridge LISP; PROLOG X £181 each
TWIN EDITOR £27

0% (APR) FINANCE

*For a limited period, Watford Electronics are able to offer the Archimedes range of microcomputers at **0% (APR)** finance. Credit facility available subject to status. Please inquire for further details.*
(Watford Electronics are Licenced Credit Brokers)

CREDIT TERMS now available. Please telephone or write in for further information.

Archimedes to BBC SERIAL LINK

Using this simple data link, it is possible to solve all your BBC to Archimedes data transfer problems. The kit is supplied with a disk, and the necessary cable to connect the two computers. Using this package it is possible to transfer any data from the BBC to Archimedes at upto 19200 baud.
By far the easiest way to transfer data to your new computer.

Only £25

Archimedes 5¼"/3½" Disc drive Interface

With this interface it is possible to connect almost any 5¼"/3½" disc drive with its own power supply to the Archimedes. Upto FOUR drives can be connected and NO SOLDERING is involved. Supplied complete with necessary lead.

Only £19

Note: This is not simply a lead. Attempting to connect an external disc drive by direct connection may result in damage to your Micro.

Watford Electronics are the main Approved Stockist of ACORN SPARES and ECONET Referral Centre

The 80186 Co-Processor

This package consists of the Master 512 board, Watford Co-Pro Adaptor, 1770 Disc Upgrade and Acorn ADFS. This is a complete package, with its own power supply, ready to interface with your BBC Micro. The Master 512 board using the 80186 16 bit Processor at 10MHz and running Digital Research DOS Plus, gives a high degree of IBM compatibility at an extremely reasonable price. Included in the 512k package is a mouse and the amazing Digital Research GEM suite of software; GEM Paint, GEM draw and GEM desktop giving a complete Mouse Icons environment (All other GEM packages will work on the 512k). Famous packages that will work with the 512k board include Wordstar, Dbase II, Lotus 123 and many others. The only requirement to upgrade any BBC Model B to this system is you must have twin 80 track disc drives.

£259

BBC MASTER

BBC MASTER 128K Micro incl. Acorn's: View, Viewsheet, ADFS, BASIC Editor & TERMINAL plus £125 worth of FREE OFFER (see below)

£379

SPECIAL OFFER

FREE . . . £105 worth of Hardware & Software

*Gemini's OFFICE MATE & OFFICE MASTER packages on Disc consisting of: Database, Spreadsheet, Beebplot graphics. Accounts packs: Cashbook, Final Accounts, Mailist, Easyledger, Invoice & Statements, Stock Control and **Watford's** 3½", double sided 1 Megabyte (unformated) single disc drive complete with cables, ready to connect to the micro – with every BBC Master purchased from us this month.*

BBC MASTER with Turbo Board + above SPECIAL OFFER £475

512K Processor Add on Board "inc. Mouse and GEM package" £185

BBC AIV (Domesday) System £3999

ADD-ONs & ACCESSORIES

Turbo 65C102 Add-on Module		£95
Econet Module for the Master		£40
Twin ROM Cartridge for Master		£7.50
Quad ROM Cartridge for Master		£12
Universal Processor Adaptor		£75
Master Reference Manual I	(No VAT)	£14
Master Reference Manual II	(No VAT)	£14
Master Advance Ref. Manual	(No VAT)	£19
64K Upgrade Kit for B+		£32
Acorn 1770 DFS Kit complete		£41
ECONET Upgrade Kit for BBC		£42
ALL ECONET UPGRADES Available		
ARIES' Professional IEEE Interface		£238
Acorn IEEE Interface Complete		£265
Morley Teletext Adaptor with ATS Rom		£99
Filestore E01		£825
Filestore E20		£705

BBC MASTER COMPACT

System 1	Standard Package	£310
System 1A	System 1 + TV Modulator	£322
System 2	System 1 + Green Hires Monitor	£364
System 3	System 1 + Medium Res Colour Monitor	£478
RS232 Kit for BBC Compact		£25
Additional 3½" Drive for BBC Compact		£90

(Securicor carriage £7)

65C102 2nd PROCESSOR

(65C102 replaces the original Acorn 6502 2nd Processor)

This amazing package consists of the Acorn 65C102 'Turbo' Board, the Watford Co-Pro Adaptor and Acorn 1.2 DNFS ROM. The 'Turbo' board, running at 4MHz with 64k of additional RAM will increase the speed by between 50 and 200% depending on the application running, and allow a BASIC program of upto 44k in any screen mode. Simply by plugging in the Co-Pro and the DNFS ROM with its special Tube host code and you massively increase the power of any Model B. This is a complete package, with its own power supply, ready to interface with your BBC Micro.

£135

Z88 Sinclair's Portable Micro

The worlds first, truly portable Micro. It is A4 size, only an inch thick and weighs under 21lbs. Ideal for use when travelling or as a personal organiser.

Only: £239

FREE

With every Z88 purchased from us this month, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.

ACCESSORIES

Mains Adaptor	£8.65
32K RAM Pack or 32K EPROM Pack	£17.35
128K RAM Pack or 128K EPROM Pack	£43.40
512K RAM Pack	£169
Z88 to BBC or PC Link	£21.70
Z88 EPROM ERASER	£34.75
Serial Printer Cable	£8.65
Parallel Printer Cable	£24.00
Z88 Modem	£86.90
Z88 Soft Carrying Case	£8.50
Sinclair Z88 Computing Book	£9.95
AA Nicad Rechargeable Battery	£1.50
Battery Charger, Compact & Fast (3 Hours)	£6

CO-PRO Adaptor

Now for the first time you can add the Master Co-processor boards, to your standard BBC model B, or B Plus. With this brand new launch from Watford Electronics you can attach any BBC Master co-processor to the original BBC Micro. Once again Watford strides ahead with a new concept in BBC B Micro add-ons. This unique external Co-Pro Adaptor, is protected by patent applications.
Use the super fast Turbo Board with your BBC B, it is much faster than the 6502 2nd processor superseding it.
With the 512K addon your standard BBC machine achieves IBM PC compatibility at a realistic price running GEM, Lotus 123 and many other programs. Included with the 512k package is a high precision mouse and the Digital Research GEM suite of software; GEM Desktop, GEM Write GEM Paint. This requires both the 1770 DFS and the ADFS to be fitted to your computer.
To use other co-processors you require a BBC B with DNFS 1.20 or higher, or BBC B+ fitted with 1770 DFS 2.20 or greater. Co-processors work exactly like a second processor.
Master owners may use Co-Pro to add a second Co-processor externally.
Watford, brings power to your BBC at only:

£35 (carr £5)

SPECIAL OFFER

EPROMs for BBC's Sideways ROMs.

2764-250nS £3.00
27128-250nS (12V5) £3.25
27128-250nS (21V) £4.50

RAMs (Low power) for ATPL, WATFORD, etc., Sideways ROM Boards

6264LP (8K) £4.50
2 × 6264LP (16K) £8.95

NEW

BBC PCB DESIGNER

At last! A PCB design package for the BBC Micro that eclipses some industry CAD software. Hard to believe, isn't it? Just look at some of the impressive package specification:

- Library Component Designer
- Component Library (over 200 parts)
- Component List Editor
- NetList Editor
- PCB Board Designer
- Plotter Driver
- Dot Matrix Printer Driver

This integrated suite of programs is packed full of sophisticated PCB related features making the design of a circuit board a dream instead of a nightmare.

Input for the design may be manual, taking components from the library and connecting them, or highly automatic starting from a netlist and list of components. In auto mode, PCB Designer will never allow you to forget a connection again! And of course, either in manual or auto mode, connectivity is maintained no matter how you later move the parts around and route the tracks. Connections snap together and angles are corrected, Through hole vias and track thickness are established automatically and many more features, far too numerous to mention here, are included in the system.

Some of the PCB Designer's features are:

- Over 120 library pad sizes/shapes
- Four colour adjustable palette
- Zoom range 2:1 to 1:4
- Highlighting of specific tracks
- Normal and surface mounted components
- Rapid screen review
- Menu driven
- Variable gridlock
- Switchable measurement grid
- Pre-select pan/scroll facility
- Large 24" x 24" Board size
- Copy route facility
- Connectivity held at all times
- Ratsnesting of part connections
- Auto-plaement of text references
- Text linked to parts
- Automatic placement of vias
- Printer and plotter outputs provided
- Comprehensive manual

TYPES OF PLOT OUTPUT

Top and bottom track artworks, top and bottom silkscreens, solder resist mask, drilling detail drawing and check plot. All these may be with pad holes on/off, scale of 2:1 or 1:1, board edge on/off, 90 degres rotation, mirror image, width of pen, x & y offsets and batch plots to disc.

The above is only a taste of the superb features of this software, surely capturing previously unknown performance from the BBC Master computer. BBC B owners will need to fit at least one block of sideways RAM, Shadow screen memory and a disc drive. A trackerball or a mouse is also required.

BBC PCB Designer is supplied on a 32K PAL PROM and comes complete with two discs and a comprehensive manual containing examples and useful information on PCB design.

By the way, as a bonus, PCB Designer is also suitable for many other schematic drawing applications such as circuit diagram drawing.

Introductory Offer: £99

(Please write in for further technical details)

Archimedes Real-Time Digitiser

Watfords' Archimedes Video Digitiser is the most sophisticated digitiser ever designed for a micro. It provides a fast and flexible means of capturing images from a video camera or recorder for display and manipulation on the Archimedes range of Micros. Off-air television signals may also be digitised via a video recorder or TV tuner.

Once captured, Video images can be stretched, squahsed, rotated, stored on disk, printed, or used by applications software.

Applications include desktop publishing, graphics, animation, image analysis and recognition, medical imaging, automatic inspection and measurement, databases, interactive video, remote transmission of pictures via a modem, movement detection ... or anything else you can think of!

SPECIFICATION

SOFTWARE
All the driver software for the digitiser is contained in a ROM on the podule. Facilities provided include:

- Grabbing of images to the screen or dumping to memory.
- Continuous grabbing and display for previewing or camera alignment.
- 'Hot key' grabbing – pressing a (configurable) key combination grabs and displays an image on the screen while another program (e.g. paint software such as Artisan) is running.
- Scaling (zoom/shrink) any section of an image to any size in X and Y directions, with optional X/Y flip, window clip and logical (AND/OR/XOR) plotting.
- Rotation and scaling to any angle and size, rotating about any point, with optional window clip, and logical (AND/OR/XOR) plotting.
- Very versatile matrix printer screendump facility for Epson FX, LQ and EX compatible printers – pictures can be printed to ANY size (including multiple sheets) at any orientation, using any available printer density and one of six internal sets of dot patterns, or with user definable patterns (pattern editor supplied). The screen-dump can also be used for general purpose graphics screen printing.
- Pixel value lookup tables: pixel values can be passed through a user defined lookup table to allow contrast enhancement, thresholding pseudo-colouring etc.
- Smoothing and noise spot removal to enhance image quality.
- Creation of sprites from all or part of a digitised image.
- Saving and loading of digitised images in compressed format.
- Combination of pictures by adding, avaraging, subtracting, multiplication etc.
- Much faster versions of the Arthur *ScreenLoad and *ScreenSave commands.

Software facilities are accessed via operating system star (*) commands and SWI calls. High resolution screen modes using MultiSync type monitors are supported.

UTILITY DISK
A disk is included, containing sample pictures, examples and utility programs including the following:

- Colour image grabbing using colour filters with monochrome or colour cameras, including colour balance adjustment and scaling facilities.
- Pattern editor for 2 colour display modes and printer screendumps.
- 512 line interlaced display for non MultiSync monitors.
- Thresholding to create two colour images.
- Capture and replay of animated sequences.
- Several example programs illustrating the use of digitiser software.

RESOLUTION
Images are digitised to 512 (h) x 256 (v) pixels, and then scaled to fit the Archimedes' screen. It is possible to digitise to 512 x 512 pixels if the picture is stationary for about 0.1 second. 512 x 512 images can either be displayed on a MultiSync monitor, or on a normal monitor using interlacing.

Pictures are digitised to 64 levels of grey (6 bits). Note, however, that it is only possible to display all 64 levels on a monochrome monitor, or a colour monitor which has a composite (CVBS) input. For this reason, the Philips CM8533 monitor is recommended instead of the standard Archimedes monitor. It is also possible to connect both a colour and a monochrome monitor at the same time.

Any 2,16 or 256 colour graphics mode can be used to display digitised pictures. In two colour modes, grey levels are represented using dot patterns, which may be redefined if required (a pattern editor is supplied).

SPEED
Video fields are captured in real time (1/50th sec.), and then transferred to Archimedes' memory or the screen. The grab/display rate is dependant on the screen mode and picture size, up to 25 fields per second for quarter screen images, or 12.5 per second for fullscreen (Mode 9).

HARDWARE
The digitiser is a single width podule, with a BNC socket on the rear panel for the video input, which may optionally be terminated via a link. There is 128K of on-board memory to store the digitised image, and a 32K ROM on the podule contains all the driver software.

Automatic video level control and black level clamping circuitry is used to ensure that the optimum contrast is obtained from a variety of video sources. A filter is included to avoid patterning effects when using colour sources.

Price £249

Continued

All Monitors are supplied complete with BBC connecting leads FREE.

MICROVITEC 14"

- 1431 – Standard resolution as used on the BBC television computer programme **£175**
- 1451 – Medium resolution, suitable for word processing in mode 0 **£225**
- 1441 – High res, exceeds the capabilities of the BBC micro **£359**
- 1431AP RGB + PAL and AUDIO **£199**
- 1451AP RGB + PAL and AUDIO **£255**
- **2030 CS 20" Med Res** **£380**
- **2040 CS 20" Hi Res** **£675**
- Dust Cover for Microvitecs **£5.50**
- Touchtec 501 Touch Screen **£239**

TAXAN 12" & 14"

- **TAXAN Super Vision 2 Type 620** Hi-res RGB Colour monitor. Ideal for Wordprocessing **£263**
- **TAXAN Super 3, Type 625** Ultra Hi-res, RGB Colour) Text mode switch allows monochrome text display in Green, Amber, White reverse or White on Blue **£313**
- **TAXAN 14" Multisync 770 Plus** – An autoscanning Ultra high res, colour monitor. Ideal for Archimedes, IBM & Compatibles **£495**
- **NEC JC-1401P3EE 14"** Multisync Ultra Hi-res Intelligent Colour monitor. Auto scans frequencies between 15KHz to 35KHz. Text switch provides 7 colours for Database & wordprocessor. **£489**

PHILLIPS Monochrome 12"

BM7502 Hi-res Green	**£69**
BM7522 Hi-res Amber	**£74**

STAR BUY

- **PHILLIPS 14"** Hi-Res, dark glass, attractively finished Colour Monitor – supplied complete with RGB, SKART and Audio/Phono Inputs. A push-button switch toggles between Hi-Res monochrome green text mode and full colour display.

ONLY £195

ZENITH 12"

- **Amber (New Design) Hi-resolution** **£72**

N.B. carriage on Monitors **£7** (securicor)

SPARE LEADS

BNC Lead for Zenith or Philips	**£3**
Skart Monitor Lead	**£5**
RGB lead for TAXAN Monitors	**£3**

SWIVEL BASES

for Video Monitors

Our professional type swivel bases have front adjustable control. This alleviates the need to lift the monitor when adjusting the viewing angle.

for 12" Monitors **£8** (carr. £2.50)

for 14" Monitors **£10** (carr. £2.50)

Anti-Glare VDU Screen

These extremely effective, easy to install, 12" & 14" VDU screens eliminate harmful glare, improves contrast on colour monitors. Increases productivity in offices. A must for all wordprocessor users. Hundreds of these screens are in daily use in various branches of one of the leading High Street banks.

£12

Acorn-Olivetti JP101 Ink Jet Printer

JP101 accepts 9½" standard fan fold paper or single A4 sheets. Tractor & Friction feed supplied as standard – print speed 50 cps. £59

Pack of 4 refills **£12**

Screen Dump ROM for JP101 £11

TAXAN KP-815 PRINTER

80 column, Bi-directional, 160 CPS, (NLQ 24cps); Friction & tractor feed + paper roll holder as standard; Epson FX compatible.

Offer Price £179

Panasonic KX-P1081

Attractively finished in BBC beige. Bi-directional, logic seeking. Has IBM and Epson RX compatible command calls. Speed: 120CPS draft mode, 24 CPS NLQ mode. Character width range from 5 cpi to 17 cpi. Upto 40 downloadable characters. Functions include, Proportional spacing, Justification, centering and left & right ranging.

(Price inludes, FREE a 4ft Printer Lead, and a Dump Out 3, Screen Dump ROM worth £35 with every printer purchased from us).

Special Price: **£145** (carr. £6)

Optional RS232 Interface: **£39**

Panasonic KX-P1082

This superb printer is very similar to the popular KX-P1081 printer but at 160 cps (40 cps in NLQ), a lot faster.

(Our LOW price also includes £35 worth of FREE BBC Cable and Dump Out 3 ROM).

Introductory Offer: **£172** (carr. £7)

Panasonic KX-P3131 Daisy-Wheel Printer

This low-cost high-performance Daisy Wheel printer is ideal for anyone wishing to produce clear, immaculate letters or reports. It delivers, flawless text at 10, 12 & 15 CPS. Supports proportional spacing. Is Bi-directional. logic seeking. Printing speed: 17CPS. Has 6k printer Buffer. A printer of similar spec could cost a lot more than our ridiculously low price of:

Only **£245** (carr. £7)

Single Sheet Feeder	**£175**
Tractor Feed	**£90**

FREE extra 32K Printer Buffer with every KX-P3131 purchased from us this month.

NEC P2200 PINWRITER

24 pin; 80 column; 168CPS – 56CPS LQ; Epson LQ compatible, 7K Buffer; 7 resident FONTS, Friction & Tractor feed, front load single sheet feed, etc.

Price: £285

Cut Sheet Feeder	**£59**
Additional Font Cartridge	**£27**

VARIOUS PRINTERS & ACCESSORIES

- Brother HR15 RS232 Daisy Wheel **£275**
- Brother HR20 Daisy Wheel **£349**
- HR20 Tractor Feed Attachment **£110**
- Epson EX800 Printer **£395**
- Epson EX1000 Printer **£529**
- Epson FX800 Printer **£295**
- Epson FX1000 Printer **£389**
- Star LC10 Printer **£175**
- Star LC10C Colour **£215**
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- Epson LQ2500+ Printer **£749**
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- EX800/1000 Colour Ribbon **£18**
- EX800 Cut Sheet Feeder **£130**
- EX1000 Cut Sheet Feeder £195
- FX/LQ/LX800 Single Sheet Feeder **£135**
- FX/LQ1000 Single Sheet Feeder **£169**
- Hi-80 Refills – Set of 4 Pens **£7**
- LX800 Cut Sheet Feeder **£75**
- LQ800 Tractor Feed **£44**
- LQ1000 Tractor Feed **£50**
- LQ2500 Cut Sheet Feeder **£195**
- LX1000 Cut Sheet Feeder **£305**
- **Hitachi 672 Colour Plotter** **£475**

(Securicor Carriage on Printers £7

EPSON PRINTER INTERFACES

All these interfaces fit inside the printer.

RS232	**£27**	RS232 + 2K Buffer	**£52**
IEEE 488	**£65**	RS232 + 8K Buffer	**£62**

KAGA/TAXAN PRINTERS

(IBM/Epson compatibles)

Kaga KP915 Printer	**£350** (carr £7)
RS232 Interface	**£49**
RS232 Interface with 2K Buffer	**£69**
RS232 Interface with 16K Buffer	**£89**

INTEGREX COLOUR JET PRINTER

- Colour Jet 132 Printer **£525**
- Paper Roll **£6**
- Screen Dump Software **£10**
- Colour Cartridge **£14**
- Black Cartridge **£8**
- 100 A4 OHP transparencies **£55**

PRINTER SHARERS

(Ideal for School environment)

Connects	Serial	Centronics
2 BBC Micros to 1 Printer	£25	£26
3 BBC Micros to 1 Printer	£36	£35
6 BBC Micros to 1 Printer	–	£99

PRINTER CHANGER

3 Printers to 1 Micro (Centronics) **£65**

(Cables extra, specify type required when ordering)

Professional Printer Stand

This new professional printer stand takes hardly more space than your printer. Due to the positioning of the paper feed and re-fold compartments ie. one above the other, the desk space required for your printer functions is effectively halved. Additional facilities include: Easy access to paper from both sides, used with both top and bottom feed paper and with its dial controlled paper feed system with adjustable deflector plates it ensures smooth paper flow and automatic refolding.

£26 (carr. £2.50)

THE EPSON RX-FX-KAGA PRINTER COMMANDS REVEALED

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities – he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out. Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON FX-KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English, how to use and make the most of your KP810, PW1080A or any other Epson FX80 compatible Printers like Panasonic KX-P1080/1, etc., with the BBC Micro, both from BASIC and Wordwise.

It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

£5.95 (No VAT)

PRINTER LEADS

Centronics lead to connect BBC micro to EPSON, KAGA, SEIKOSHA, NEC, STAR, JUKI, BROTHER, SHINWA, Panasonic etc. printers.

Standard length (4 feet long)	£6
Extra long (6 feet long)	£8
Compact's Special Centronics Lead	£9
RS232 Cable	P.O.A.
IBM Parallel 1 metre Cable	£7
Double ended 36 way Centronics Lead	£9

PRINTER RIBBONS & VARIOUS DUST COVERS

Type	Ribbons	Dust Covers
BBC Micro	–	£3.50
BBC Master	–	£4.00
Archimedes Micro pair	–	£9.00
Brother HR15/20	£3.00	£5.00
EX/LQ800	£7.50	£4.50
EX/LQ1000	£8.00	£5.00
RX/FX80/85/800/MX80	£4.00	£4.95
RX/FX100/1000	£6.00	–
Kaga/Texan KP810/815	£5.25	£4.00
LQ2500	£9.00	£5.50
LX80/86	£4.00	£4.50
LX800	£4.00	£4.75
M1009/GLP	£4.00	£3.75
Panasonic KX1080/81	£4.50	£4.75
SQ2500	£25.00	£5.50
Star NL10	£4.00	£4.50
Microvitec Metal	–	£5.50

Our attractive Dust Covers are manufactured from translucent PVC. The seams are stitched and edges are taped to prevent splitting due to continuous use.

Listing Paper (Perforated)

- 1,000 Sheets 9½" × 11" Fanfold Paper **£7**
- 2,000 Sheets 9½" × 11" Fanfold Paper **£12**
- 1000 Sheets 9½" × 11" NCR 2 Part Fanfold **£19**
- 1,000 Sheets 15" × 11" Fanfold Paper **£9**
- 1000 Sheets true A4 Fanfold Paper **£11**
- 2000 Sheets true A4 Fanfold Paper **£20**
- Teleprinter Roll (Econo paper) **£4**

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached).

Carriage 1K Sheets £2.50. 2K Sheets £3.00

PRINTER LABELS

(On continuous fanfold backing sheet)

1,000 90 × 36mm (Single Row)	£5.00
1,000 90 × 36mm (Twin Row)	£4.90
1,000 90 × 49mm (Twin Row)	£7.50
1,000 102 × 36mm (Twin Row)	£6.25

Carriage on 1,000 Labels £1.00

MEGABUFFER 256

This new Megabuffer 256 from Watford is a full featured 256K Printer Buffer. It allows the computer to print 256,000 character in a short time thus freeing the computer very quickly. In short it makes light work of printing large documents, screen dumps, etc. It is extremely simple to connect. The features are:

- Low Cost, High performance.
- Improves efficiency by making more efficient use of computer and printer.
- Compatible with any computer and printer that uses Centronics Parallel connections including all BBCs, IBM PCs, etc.
- Total compatibility with all software.
- Cheaper phone bills when using your Modems.
- Ideal for those doing large graphics screen dumps that are slow to print.
- Multi-Copy facility allows you to print several copies via Megabuffer without going through your computer.
- Data Dump facility is included.
- Built in test unit for both the buffer & your printer.

In conclusion it can safely be said that MEGABUFFER 256 is the ultimate printer Buffer for both the amateur and professional user.

Only £125 (carr £2)

OFFICE MASTER

CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trail balance.

FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.

INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.

STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE

- DATABASE
- BEEBCALC SPREADSHEET
- BEEBPLOT GRAPHICS

DATABASE – Set up a computerised card index system with powerful search facilities.

SPREADSHEET – Offers many calculation and editing features.

BEEBPLOT – Provides visual representation from Spreadsheet data.

OFFICE MATE Only £10 (Disc)

New Launch Offers
Disc Drives DP35-800S

A Double disc drive – with a difference! Times are changing fast for the floppy disk, and whilst the current standard for the BBC B and Master Series is the 5.25 inch disk, the standard for the future will most certainly be the smaller; faster and more reliable 3.5 inch disks – now a standard feature of both the Master Compact and the Archimedes Series.

To support the present disc drive users, and cope with the future, we have designed our own plinth-mounted disk system – called the DP35 800S, it contains both the 5.25 inch and the 3.5 inch drive formats as well as offer a firm and rigid support for a monitor on top. With the BBC Micro underneath, the plinth makes a surprisingly small footprint on the desk – leaving you more space to work with.

The 5.25" disc drive is 40/80 track switchable. For ease of access, the switches are front mounted. The unit has its own power supply, independent of the BBC Micro.

Watford's new plinth enables users to read, write and format disks both in DFS and ADFS format – currently the accepted standard for the Master Compact and the Archimedes, it also enables the user to read disks written for the Archimedes. Ideal for both BBC & Master.

Launch Offer: **£165** (carr. £7)

OKIMATE COLOUR PRINTER

The first ribbon transfer printer in its price range which offers fully versatile colour or black printing. A 24 element print head produces more than 100 shades with exceptional clarity. Ideal for use with Quest Paint or AMX Super Art.

Only: **£139**

BBC Screen Dump	£10
Colour Ribbon	£6
Black Ribbon	£6

30 Megabyte Winchester Drive

Undoubtedly the best value for money Winchester Hard disc available anywhere for the BBC Micro.

This 30 Megabyte hard disc is completely compatible with the Acorn ADFS – that's why we have bundled it with each Winchester drive, along with a full user guide and full utilities including file copy, 1000K save routines, Format and Verify – in fact all you need and more.

Finished in rugged metal and fetching BBC beige, the Winchester has an internal fan, so quiet you won't even hear it! A switched mode power supply and a neon-lit on/off switch are there along with a light on the hard disc to tell you when it is working – just compare the price with our competitors' 20 or 28 Mbyte discs!

Compatible with the Master, and the BBC B (with 17" X disc interface).

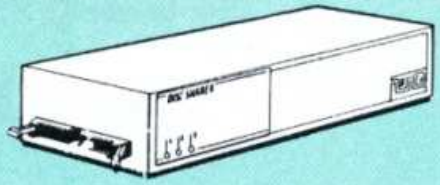
Launch Offer **£425** (Carr. £12)

Panasonic KX-P1083

Fast 240CPS (48CPS NLQ);
8K Buffer, Epson compatible, etc.
Launch Offer: £299

NEW

DISC DRIVE SHARER



(Ideal for educational establishments)

At last, a low cost alternative to the Econet system. Watford's Intelligent Disc Drive Sharer allows you to connect 3 BBC micros (model B, B+ and Master series) to a single or double disc drive. Running under any DFS or DDFS, this intelligent unit will automatically queue the computers. Each computer has a status light dedicated to it. If it is green you will get immediate access to the disk, and red means that you are next in line. The unit plugs directly into the disc drive socket on each computer and is powered by the mains. (N.B. Not for use with ADFS.)

Launch Price: **£59** Price includes 3 Cables

NOW WITH EXTRA FEATURES AT NO EXTRA COST – Watford's latest DFS 1.44

- Incorporates Acorn's Official Tube Host Code so that those with 2nd processors no longer need to waste a ROM socket on the DNFS.
- Option to DOUBLE the speed of BPUT and BGET.

If you already have the Watford Electronics DFS and wish to incorporate these new facilities then simply return your existing DFS ROM to us together with £5 remittance for an upgrade. Please pack the ROM securely and address the package to our Upgrades Dept.

WATFORD's & ACORN's SINGLE DENSITY DFS

Watford's popular and widely acclaimed DFS has now been available for five years and has gained a large following amongst serious and educational users of the BBC Micro. Owners of Acorn or any other standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for this upgrade. ***(P.S. Watford's highly sophisticated DFS is fully compatible with Acorn DFS). (not Acorn's 1770 DFS)***

- *Complete Disc Interface Kit including DFS ROM and fitting instructions* **£78**
- *Acorn's 0.90 DFS Kit complete* **£79**
- *DFS Manual (Comprehensive)* *(no VAT)* **£6.95**

(P.S. Our DFS manual is the only comprehensive Manual available for the BBC micro and covers both Acorn & Watford DFSs).

- *Watford's sophisticated DFS ROM only* **£16**
- *We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only* **£12**
- *DNFS ROM only* **£17** • *ADFS ROM only* **£25**

NEW

WATFORD's Mk II Double Density DFS INTERFACE

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our MkII DDFS board has been adapted to allow the use of Acorn ADFS as well.

Added features include:

- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET.
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!

If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£30.00**.

- Special introductory offer **£39.00**
- DDFS Manual (No VAT) **£6.95**
- We will exchange your existing DFS Kit for our sophisticated DDFS for only **£25.00**

Please note, as the MkII DDFS is a hardware and software upgrade, it is not possible for existing Watford DDFS users to simply exchange their ROM for the new version.

SPECIAL DISC DRIVE/DDFS OFFER

CLS400S

- The popular Mitsubishi 400k Single Disc Drive, Double Sided, cased with Cables. Plugs directly to your Micro.
- Watford's popular DDFS Disc Interface (allows 720k storage). Will run in both Single and Double Density modes 40/80 track Software switchable.
- A comprehensive User Friendly Manual.

A Bargain at Only **£130** (£6 carr)
(Offer valid while stocks last)

3½" DISC DRIVE OFFER

These top quality 3½" Double sided, 80 track, 1 Megabyte (unformatted each Disc Drives), are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc. They run directly from the BBC B/Master's own PSU.

- Single 400K Drive **£69**
- Twin 800K Drives **£126**

Mysteries of Disc Drives & DFS Revealed

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.

Then The Mysteries of Disc Drives and DFS Revealed is the book for you. It explains in detail the different types of systems available, how they are installed and how to use them. Many examples are given including pre-written programs to call various functions of the DFS available only through Operating System calls. Different types of disc, 40/80 tracks etc. are all explained. This book is ideal for the beginner confused by the plethora of choice available in the marketplace.

£5.95 (Book No VAT)

DISC ALBUMS

Attractively finished in antique brown leather look vinyl. Stores upto 20 Discs. Each disc can be seen through the clear view pocket.

£4

FLOPPY HEAD CLEANER KIT

The heads in floppy drives are precision made and very sensitive to dirt. The use of a cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. It is very simple to use. Available in 3½" & 5¼", please specify.

£6

ANTISTATIC LOCKABLE DISC STORAGE UNITS

Gives double protection – Strong plastic case that affords real protection to your discs. Antistatic helps avoid data corruption whilst in storage. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

- **M35** - holds upto 50 5¼" discs **£6.00**
- **M85** – holds upto 95 5¼" discs **£8.00**
- **M25*** – holds upto 25 3½" Discs **£5.50**
- **M50** – holds 50 3½" Discs **£7.50**

* Not lockable

PLASTIC LIBRARY CASES

Holds up to 10 5¼" Discs. **Only £2.00**

DISC PLONKER RACK

When using ones micro, there is a tendancy to have more than one Disc on the desk. This exposes them to the hazards of fingerprints, scratches, dust, coffee and an untidy desk.
Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost DISC PLONKER RACK. It holds up to eight 5¼" Discs.

Protection at Only: **£2**

DUST COVERS (For our Disc Drives)

Single CLS (without PSU) **£3.20** Twin CLD (without PSU) **£3.85**
Single CS (with PSU) **£3.95** Twin CD (with PSU) **£3.90**

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates capacity in single density mode. That within the brackets is the capacity in double density mode. All disc drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). All our 80 track drives are already fitted with a 40-80 select switch.

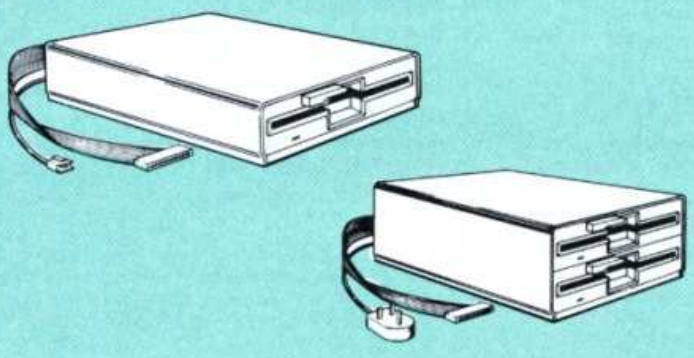
***All our Disc Drives are Double Sided and will operate in both Single and Double Density modes**. Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*

Various other "manufacturers" of disc drives for the BBC micro (more accurately, "packages" label other manufacturers drives with their own name). We buy the high quality JVC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. Ideal for Schools & Colleges. We are now able to supply all single disc drives with Power Supply, in either single or dual case. (Dual case has a twin data cable and a power supply capable of driving two disc drives) allows easy expansion to a dual drive unit, at a later date. Prices stated in the pricing boxes below are for single drives in standard single cases. Single drives in a dual case cost an extra £5. (At Watford we anticipate your needs of tomorrow, not just today)!

When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space) your BBC, Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with Watford plinth. (Turn to the 6th page of our advert for the Plinths).
P.S. All our 5¼" Disc Drives with PSU are compatible with the Compact Micro. All you require is the special Compact Disc Drive Cables designed by us.



Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
200K (360K)	CLS 200 £89		CS 200 £98	
400K (720K)	CLS400S £85	CLD 400 £168	CS 400S £96	CD400 £188
800K (1.44M)		CLD 800S £167		CD 800S £186

● TWIN Disc Drive Case, complete with Power Supply & Cables **£43**
Securicor carriage on Disc Drives £5 to £6

Prefix **C** = *Cased Drive*
L = *Less PSU*
S = *Single*
D = *Double*

Suffix **S** = *40-80 Switchable*

e.g. CLS400S = Cased Disc Drive, Less power supply unit, single 5¼" 400K, (720K in double density); Double sided; 40/80 track switchable.

Cable to connect 5¼" Disc Drives to BBC Compact
Single £9 Twin £12
Special Cable to connect both 3½" and 5¼" Disc Drives
simultaneously to the BBC Compact £13

3M – DISKETTES

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electronics your 3M Appointed Distributor.

- *10 × 5¼" S/S D/D 40 Track Diskettes (744)* **£8.00**
- *10 × 5¼" D/S D/D 40 Track Diskettes (745)* **£9.75**
- *10 × 5¼" S/S D/D 80 Track Diskettes (746)* **£12.50**
- *10 × 5¼" D/S D/D 80 Track Diskettes (747)* **£12.75**
- *10 × 5¼" 1.6M D/S D/D High Density Discs for IBM XT and AT* **£28**
- *10 × 3½" S/S D/D 40/80 track Discs* **£13.50**
- *10 × 3½" D/S D/D 40/80 track Discs* **£15**
- *10 × 3½ High Density Diskettes* **£43**

FREE

This extremely useful and attractive Personal Leather Organiser worth upto £50 is yours when you buy from us, 5 Boxes of any of the 3M range of Discs that we advertise above.

TOP QUALITY 3½" & 5¼" DISKETTES

To complement the range of quality discs and disc drives that WE already sell, WE are now supplying some special offer packs of 10 high quality discs. Each Disc has a reinforced hub ring and carries a lifetime guarantee. These are supplied complete with selfstick labels and packaged in an attractive plastic library disc box. We strongly recommend these Discs.

- *10 × **M3** 3½" D/S D/D 80 Track Discs* **£13**
- *10 × **M4** 5¼" S/S D/D 40 Track Discs* **£6.50**
- *10 × **M5** 5¼" D/S D/D 40 Track Discs* **£8**
- *10 × **M7** 5¼" D/S D/D 80 Track Discs* **£9**
- *3" Double Sided Discs* **£3** *each*

Special BULK OFFER on 5¼" DISCS

PRICES SLASHED

(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)

BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
● Without Sleeves	£35	£39	£45
● With Sleeves	£38	£42	£48

PRICES SLASHED

WATFORD's WINCHESTER DRIVES

- 10 Megabyte Unit with ADFS **£375**
- 30 Megabyte Unit with ADFS **£425**

(30 Meg Unit is supplied complete with utilities software. For full details see Page 4 of our advert)

CDP800S **CDPM800S**

Twin 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The mains switch with neon On/Off light indicator, and the two 40/80 track switches are mounted on the front panel for ease of use.

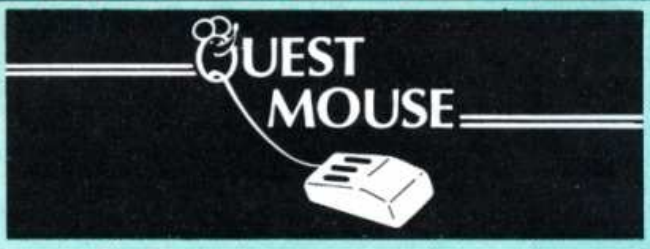
CDP 800S for BBC Micro £192
CDPM 800S for Master £196
DP35-800 for BBC/Master £165
(For DP35-800S spec. see Page 4 of our advert)

(Securicor Carr. £7)
(The above drive units are 2 Megabytes unformatted)

Continued

NOMINATED FOR BRITISH MICRO COMPUTING AWARDS 1987

QUEST MOUSE



QUEST MOUSE

The ultimate in Mouse technology, the Watford Electronics Quest Mouse must be the most powerful Mouse package yet produced for the BBC Micro. Featuring state of the art 32K ROM software the Quest Mouse package is filled with features essential to the budding artist. The Quest Mouse is a high precision, low profile and large footprint mouse. It has three large comfortable buttons and its RUBBER COATED STEEL BALL is smooth and easy to use on virtually any work surface. This also eliminates any directional bias that one encounters on the most well-known mouse for the BBC. The Quest Mouse is FULLY HARDWARE COMPATIBLE with the AMX MOUSE so that it will work with any of the AMX range of software.

The two parts of the Quest package are available separately so that existing Mouse owners can upgrade to the Watford's sophisticated Quest Paint software or replace their existing worn out mice for a minimum cost.

QUEST PAINT

The Quest Mouse software is supplied on a PALPROM unit to allow the sophisticated 32K program to be used from a single ROM socket. It is compatible with the BBC B, BBC B Plus and BBC Master Series machines.

The software is used to draw high resolution Mode 1 pictures in full colour. All menu selection and control of the drawing process is performed with the mouse so that you will hardly ever touch the keyboard.

SOFTWARE FEATURES

The software is far too powerful for us to describe it fully in such a small space. Below is a list of the various features. Please write to us for a fully descriptive leaflet.

Disk interface not required. Utilities disk has facility to create and print big screens. Colours applied can be solid, either pattern of user defined pattern. Drawing can use brush or airbrush. Brush shapes can be defined and stored. Airbrush sprays colour/pattern randomly with four jet sizes and even or center spread. Colour cycles. Colour protection to stop particular colours from being overwritten by selected drawing actions. All standard drawing facilities like: rubber, straight pencil lines, triangles, circles, ellipses, rectangles, parallelograms, polygons, etc are provided. All shapes can be solid or just a boundary line. Once a shape has been set up it can be repeated anywhere on the screen. Global colour replace in a rectangle. Powerful fill facility for areas and vertical/horizontal lines. Full cut and paste of rectangular areas with rotation and size with screens from Watford Beeb Video digitiser. Load and Save screens with colour pallet information, save brush and pattern definitions etc.

Take The Guesswork Out of Selecting a Mouse Package

With reviews like this how can you go wrong.

Popular Computing Weekly, 9-11 June '87
"What you actually get for your money is a well built, three button mouse (far superior to the AMX mouse)."
"Overall the combination of a quality mouse and decent art package gives Watford Electronics a real chance of supplanting AMX as mouse supremos."

Micro User June '87
"Quest Mouse and Quest Paint can hold their heads high in the market. . ."

A&B Computing June '87
". . . Watford Electronics, a company famed for excellent hardware add ons and versatile software packages. Called Quest mouse, "this is a very special mouse driven drawing package..."
". . . you will have one of the most comfortable and professionally built mice I have used in a long time. The buttons are responsive, the mouse movement is smooth and without directional bias – a pleasure to use."
"What we have here is probably the best art package there is for the BBC Micro . . ."
"Quest Paint is a major leap forward in BBC programming. . ."
"Quest Paint is an original piece of programming, it is friendly and well endowed with many useful facilities. I would comfortably say it is easier to draw good pictures with Quest Paint than it is with more expensive 'Professional' art packages for the Atari ST and the Commodore Amiga. A recommended buy if you are looking for the best in BBC micro based art packages".

Acorn User, September '87
"The mouse (Quest) performs well in the face of competition from AMX, Wigmore and the rest . . ."
". . . this package represents excellent value for money. If you are interested in art then this program is for you to buy"
"Given time, I can see no reason why Quest Paint shouldn't take on the title of the definitive art package available for the BBC Micro to date".
"All in all, Quest Paint is a very professional package. It contains virtually every feature the budding artist could require".
"What makes Quest Paint so versatile is the addition of a sub-menu which allows you extensive control over each function"
"Until recently, Superart from AMS had been judged as the definitive mode 1 graphics package for the BBC micro. But now it has a serious rival in the form of Quest Paint, from Watford".
"As a measure of what is contained within Quest Paint, I would say it had all the features of Superart plus . . ."
"In most art packages, provision is given for drawing triangles and rectangles. Quest Mouse goes 14 better, allowing any regular polygon of upto 16 sides".
"One facility, not found on any other Art package to my knowledge, is the ability to access a digitiser from within the program".
The reviewer concludes by saying, "The result is an extremely comprehensive and professional art package"

John Kilby, Head of Computer Science, Bishop Wulstan High School, Rugby, writes:
"Quest has been an excellent piece of equipment. The problem that seems to occur everyday is that at lunchtime the pupils rush to the computer room to make sure that they are first in the queue for the 'Quest' mouse"

Lt. Cln. C.G. Holton, G2 HQ 1 (BR) Corps, BFPO 39, writes:
"As ever your service is superb and the Quest Mouse proves every bit as good as the adverts claim".

Beeblet User Group, New Zealand Oct '87:
"One of its nicer features is that the top menu is done in Mode 0, the drawing itself is in Mode 1. Thus on screen together are two different Modes. A neat way around an old problem".

"PAN is used when a larger than one screen size image is required. The mind boggles at an A3 size drawing".

"I like it partly because of the mouse itself which is smooth and easy to handle but mainly I suppose because of the features I longed for and previously never got. Its easy to use with almost everything at your fingertips from the mouse. The software is simple where needed and complex where complexity is required".

ConQuest

Watford's Quest package is an extremely powerful and flexible drawing package, with very wide and unusual features. However, since its launch various suggestions for even more advanced & powerful facilities were received from the Quest users. ConQuest allows you these more advanced facilities, like, distortion of a cutout to any shape and a full font designer. If you also have a GXR ROM in your machine or you are using a BBC Master then ConQuest will take advantage of this to give ellipses at any angle, sectors and arcs, etc. Quest combined with ConQuest and Acornsoft GXR ROM make up THE MOST POWERFUL drawing packages available for the BBC range. Quest Paint is able to take advantage of almost any additions to your machine, such as Shadow or Sideways RAM. ConQuest takes this principal even further, by utilising the otherwise normally incompatible Sideways RAM facility by holding pictures in them.

Some of the features are:

- *Pick filenames off the screen for loading and saving.*
- *Rotate a cutout to any angle and Distort it to any four sided shape.*
- *Has Built in Font editor.*
- *Default brushes and patterns on startup.*
- *16 x 16 font available on start up.*
- *Ability to reset patterns, fonts and brushes to default at any time.*
- *ROM based enhanced Epson and compatible printer dump.*
- *ROM based enhanced extended picture routine.*
- *Ability to create and abort extended pictures.*
- *Improved disk access speed for extended pictures.*
- *User definable sideways RAM driver for incompatible sideways RAM systems.*
- *Ellipses at any angle on Master 128 (or B with GXR ROM).*

QUEST MOUSE & QUEST PAINT	***£59***
QUEST MOUSE, QUEST PAINT, AMX PAGEMAKER & PAGEFONT	***£85***
QUEST MOUSE ONLY	***£29***
QUEST PAINT SOFTWARE	***£32***
QUEST FONT DISC	***£12***
ConQuest 32K ROM Package	***£29***
QUEST MAT	***£3***
Part-exchange your old Mouse for a New QUEST MOUSE for only	***£23***
GXR ROM for BBC Micro	***£22***

N.B.
1. Quest Paint supplied complete with Software in a 32K ROM, Comprehensive User Guide and a Utility Disc.
2. Quest Font Disc has 22 text FONTS for use within Quest Mouse.

MARK II LIGHT PEN

Our Mark II Light Pen is the very latest in light pen technology. It is totally insensitive to local lighting conditions and works with many different monitors. The pen only responds to the High Frequency light produced by your monitor/TV. An LED indicates when valid video data is being produced. A conveniently located switch is also fitted.

Price Only £21
(Price includes FREE software Disc and Operating Manual)

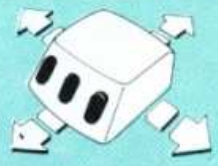
RB2 Marconi Tracker Ball

RB2 (AMX/Quest compatible)	£52
RB2 including Quest Paint	£78

FLEET STREET EDITOR

Software pack for BBC Micro	£33
Software pack for the Master	£39
Software Pack for Compact	£40
Admin Xtra Disc Utility	£13
Walt Disney Disc Utility	£13
Fonts N Graphics Disc Utility	£13

THE NEW Mk III AMX MOUSE



ONLY: £59 Inc. Super Art package
(carr £1.50)
(Please specify for BBC, Master or Compact)

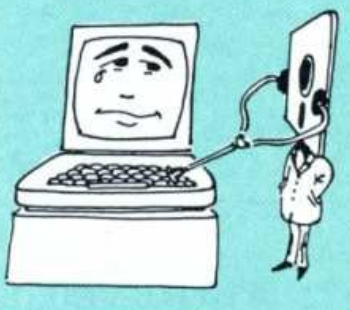
FREE our popular Colour Art software pack worth £15 with every AMX Mouse package purchased from us.

AMX MAT	£3
AMX MOUSE ONLY	£29
AMX UTILITY Package	£11
AMX SUPERART Package	£34
AMX STOP PRESS – A Desktop publising software. Works with Keyboard, Joystick or a mouse	£32

We are giving away absolutely FREE, our PAGE-FONT disc with every purchase of STOP PRESS from us.

PAGE-FONTS – Over 20 Fonts for use with AMX Pagemaker	£12
AMX DESIGN (ROM)	£55
AMX 3D ZICON Disc	£19
AMX XAM Educational	£15
AMX EXTRA EXTRA	£16
AMX MAX A gem of desktop (ROM)	£15

DIAGNOSTICS DISC



The BBC Micro is a very complex machine and thus diagnosing a fault can be very difficult. At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.
The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:
RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.
This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Only £20.00

BEEB VIDEO DIGITISER

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.

This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.

Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem.

The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.

Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional * commands. The package i designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROMs to work on it.

A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image.

Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

£109 (Carr. £3)

(Price includes) Digitiser Unit, Software in ROM & a Comprehensive Manual)
(BBC B+ and Master compatible, except Master with Econet)

Magazine Maker

(As seen on TV)
A combination of the Pagemaker and Watford's Beeb Video Digitiser.

Using any video that provides a composite signal and the digitiser, images from a camera or TV can be converted into a graphics screen on the BBC Micro.

They can then be used within Pagemaker to illustrate magazines or newsletters – in fact anything that needs to be created on A4 size paper.

With Pagemaker's many features, a variety of pictures can be composed – the only limit being the imagination.

Pictures can be doctored using Pagemaker's graphics option to produce any number of effects.

Text can be formatted around the digitised photo on screen using the facilities available, which include 16 typefaces, character and pattern definer, text formatting and the ability to load in wordwise and viewfiles plus much more.

Once created the picture can be printed out.

The Magazine Maker is suitable for any use that requires illustrated documents.

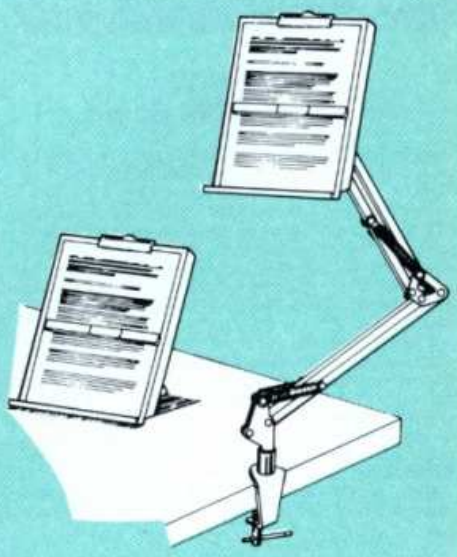
Complete Package **£135.00** (carr. £3)

PLINTHS FOR BBC MICRO, MASTER & PRINTERS

Protect your computer from the weight and heat of your monitor. The BBC micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and monitor, whilst the double height version provides enough room for our stacked or side-by-side dual disc drives or TORCH Disc pack, to be placed in the centre section. If you use our stacked drives, the remaining space can be used for further peripherals e.g. Speech Synthesizer, EPROM programmer or simply stationery. The computer slides neatly in to the lower section allowing easy access to remove the lid. The printer plinth is equally sturdy but without the cooling slots. It allows for access to the paper from the front as well as from the rear, (a facility not often thought of in similar products) if the paper is located beneath the plinth. This is a very convenient way to work especially if your work area is not deep enough to take the printer and paper separately.

SINGLE BBC PLINTH	**£11** (carr. £1.50)
DOUBLE BBC PLINTH	**£19** (carr. £3.00)
PRINTER PLINTH	**£10** (carr. £1.50)
SINGLE MASTER PLINTH	**£14** (carr £1.50)
DOUBLE MASTER PLINTH	**£24** (carr £3.00)

COPY HOLDERS



How often have you been about to type hand written notes into your computer when you find that there's nowhere to rest the paper or that your notes are resting at the wrong angle to read the type? Whether the notes be your latest program or the draft of a new trilogy, the new Manuscript Holders from Watford are superb for holding your paper at the ideal height and angle to allow you read and type in ease and comfort.

Available in 2 versions, desk resting and shelf clamping versions, these two units hold your paper firmly by means of a plastic retaining ruler and a clip grip. Both units are full A4 size.

Amazing value at only
Desk Top **£10** (carr. £2)
Angle poise **£14** (carr. £3)

Continued

ARIES CORNER

The Aries B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Comal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved *FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on your BBC micro – no flying leads to connect and no soldering. Provision of the on-board ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Price: **£80** (carr. £2)

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234 or 33383

Aries B-12 Sideways ROM Board

This board is extremely well made, simple to install, reliable when fully loaded and compatible with the Aries-B20 and the Aries-B32

The B12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

The B12 system consists of two parts: a large detachable "mother board" which carries the extension ROM sockets and a small "base board" on a short ribbon cable, which plugs into the existing sideways ROM sockets. This two-board design eliminates the reliability problems previously associated with some other ribbon-cable based systems.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost.

Price: Aries B-12 **£40**
Aries B-12C **£5**

ARIES B-488 IEEE-488 INTERFACE UNIT

The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB' or 'HP-IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

£238 (Carr £3)

All prices in this advert are exclusive of VAT.

SIDEWAYS ZIF SOCKET

Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.
- The low profile of the socket allows unrestricted access to the Keyboard.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.
- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for all professionals and Hobbyists alike.)
- BBC, B+ and Master compatible.

ONLY **£16** (carr £2)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack for the BBC B.

● Complete System	**£11**
● Spare Cartridges	**£2.50**
● Spare Rack	**£1.50**

ROM Cartridges for the BBC Master
Twin **£7.50**; Quad **£12**

16K Sideways RAM Modules

Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

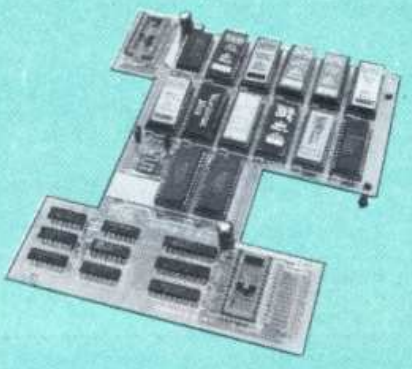
- Write protection (useful in a variety of circumstances).
- Read protection (allows recovery from ROM crashes).
- Compact construction.
- May be fitted in systems even with a ROM board.
- Multiple units may be fitted, even with a ROM board.
- No overheating or overloading problems.
- Free utilities disc supplied.
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

Only: **£24** (carr £2)

Optional extras

READ and WRITE protect Switches **£2** each
Battery for Battery Backup **£3**

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



In the May 1986 Micro User's independent review, the writer concludes, "The board has been well laid out. Its position is much better than others – not over the HOT RAM chips and further away from the disc controller area". "I give the solderless ROM board the thumbs up and wish it success".

This brand new board from Watford Electronics is designed specifically for those wishing to add a ROM board to their own BBC without the need to perform any soldering.

This new board expands the total possible number of ROMs in a BBC from 4 to 16.

Unlike our competitors inferior boards, the ONLY upgrade required for fitting battery backup to the Watford Solderless ROM board (all Watford ROM boards, actually) is the fitting of the battery itself. (No other expensive components are required.)

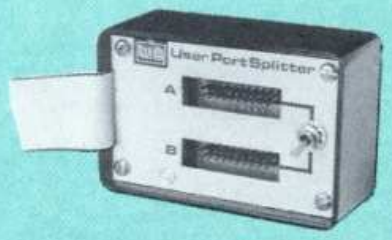
- The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 takes two 6264 RAM chips.
- Read protect to make RAM "Vanish") allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £32
Battery backup fitted **£36**
Battery Backup only **£3**
(carriage £2)

- Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

Only: £8

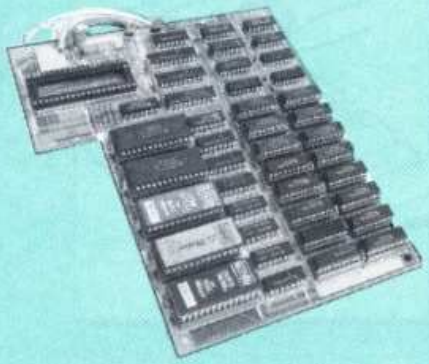
USER PORT SPLITTER UNIT



Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaniously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination.

Excellent Value at **£21** (carr £2)

ROM/RAM CARD



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 3 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO overheating problems.
- No User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Firm mounting in BBC micro.
- Compatible with all BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of Battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- Accepts any ROM.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE Fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROM-SPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

Please write in for further details.

INTRODUCTORY PRICES:

- ROM/RAM card with 32k dynamic RAM ***£45***
- ROM/RAM card with 64k dynamic RAM ***£59***
- ROM/RAM card with a massive 128k dynamic RAM **£89**

(carriage on ROM-RAM Card £3)

OPTIONAL EXTRAS:

- 16k plug-in Static RAM kit **£9**
- 16k Dynamic RAM for Upgrade **£9.20**
- Battery backup **£3**
- Read and Write protect switches ..... **£2** each

Complete ROM-RAM board
All options installed **£106**

P.S.
Is your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford ROM/RAM Board and pay £5 less

Le Modem

The MODEM from Watford

At last a professional MODEM for the BBC Micro. Unlike other 'Modem packages' this is a complete package there are no extra software costs to get 'up and running'. Of course Le MODEM is multi-standard, i.e. 300/300, 1200/75 & 75/1200 UK and BELL (USA) are all supported.

The features that make Le MODEM such good value are:

- *A complete communications terminal that transforms your BBC Micro into a very powerful World-wide data transfer system.*
- *Auto Dials, Auto answers, and is completely controlled by your micro. There are no external controls!*
- *Allows you to access PRESTEL, B.T. GOLD, THE SOURCE, MICROLINK, MICRONET, MICROWEB, THE TIMES NETWORK, MICRO LIVE (BBC TV database), CITY BB and more.*
- *Designed to be SIMPLE but SOPHISTICATED. To LOGON to a data base all you have to know is its TELEPHONE NUMBER. Le MODEM does the rest.*
- *Supplied with a comprehensive telecomms package in a 16K sideways ROM which includes a FULL PRESTEL terminal allowing TELE-SOFTWARE to be downloaded.*
- *A comprehensive 80 column terminal. This includes XMODEM error checked transfer protocol, to allow error free data transfer anywhere in the world!*
- *FULLY controlled by simple '*COMMANDS allowing you to control it from your own BASIC programs. To get you started we supply a FREE disc of bundled software!*
- *Connects to the 1MHz bus. A *AUDIO ON-OFF command allows you to actually hear the telephone line through your BBC micro loudspeaker.*
- *Completely self contained with internal mains power supply. (Even a free mains plug is fitted!) A *TEST facility gives ON SCREEN indication that Le MODEM is working correctly.*
- *Packaged in such as way that you need nothing else except a BBC Micro to communicate with computers all over the world.*
- ***FREE Registration to MicroLink.***

SPECIAL OFFER

Price: ***£88***
(carr £3)

(Price includes, Le Modem, Software ROM, Cables & Comprehensive Manual)
(Write in for further details)

Minerva Systems Software

System Delta with Card Index	£55
System Programmers Ref. Guide	£19
System Gamma	£43
System Gamma Prog. Ref. Guide	£19
System Mailshot	£17
System Reporter	£17
System Intrer/View Link	£17
System Sales Ledger	£39
System Purchase Ledger	£39
System Nominal Ledger	£48
System Stock Management	£39
Order Processing/Invoicing	£39

APOLLO

The NEW Modem from Watford

Following numerous requests from you, our discerning customers for an APPROVED, Low Cost & High Performance modem with Auto Dial & Auto Answer facilities as standard) we bring you the versatile APOLLO Modem. Just compare the features and look at the price (which incidentally includes the cost of the Software, manual and BBC connecting cable). We are sure you will agree that Watford Electronics in their traditional way are giving you a super 'value for money' deal.

Just look at these features:

- V21 for Bulletin boards, Microlink, Telecom Gold, etc.
- V23 for Prestel, Home Banking, and other Viewdata services.
- Reverse V23 allows User run Viewdata service.
- 1200-1200 half duplex for communications.
- XMODEM, HEX and ASCII file transmission.
- Auto Dial of given 'phone number.
- Auto Answer for User's Bulletin Board.
- 80 column terminal with split screen facility.
- Prestel text screen dump.
- Fully BABT approved.
- **FREE Registration to MicroLink.**
- **£6.50 off annual Membership to Micronet, Prestel and Telecom Gold.**

The Apollo is attractively finished in matt black. It opens the doors to world communication to both, the Hobbyist and the Professionals alike. With baud rates varying from 300/300 Originate and Answer, 1200/75 and 75/1200 full duplex and 1200/1200 half duplex, virtually all the popular tele-services can be accessed. A comprehensive Comms ROM oversees the use of the APOLLO, providing simple commands for all the software controlled facilities. APOLLO is an ideal modem for both the first time buyer and the seasoned user. Join the Telecommunications Revolution – Buy a Watford APOLLO!

Only: **£88** **(Carr £3)**
Price includes, the Modem, Comm Software Cables & Operating Manual).
(Write in for full specification)

VOLTMACE JOYSTICKS

Delta 3B Single Joystick	£12
Delta 3B Twin Joysticks	£17
Delta 3C Joystick for Compact	£10
Delta 14B Single Joystick	£12
Delta 14B/1 Adaptor Module	£12
Transfer Software Disc-Tape	£7

ATTACHE CARRYING CASE

For the BBC Micro. Attractively finished in antique brown leatherette. Lockable.

Only **£10** (£2 carr.)

Versatile BEEB SPEECH SYNTHESISER Unit

The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

Supplied with an advanced ROM, you are provided with a 500 word dictionary to get you started. These can easily be added to by following the notes given in the comprehensive manual.

SPECIAL PRICE £32 (carr £2)

Continued

COMPUTER CONCEPT'S ROMS

ACCELERATOR	£46
CARETAKER Basic Utility	£23
DISC DOCTOR	£28
Graphics ROM	£29
TERMI	£25
COMMUNICATOR	£49
SPEECH ROM	£24
Printmaster	£25

Wordwise £23

Wordwise plus £40

We are giving away absolutely **FREE**, the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear text-segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc Interface in your Micro)

HI-WORDWISE-PLUS DISC: £5

SPELL MASTER £42

Inter SHEET ONLY £37

INTER-CHART ONLY: £25

Inter-WORD £36

MEGA-3 ROM

Interword, Intersheet & Interchart – 3 in one ROM £76

INTERBASE £49

All Prices Exclusive of VAT

VIEW

VIEW WORDPROCESSOR 2.1	£35
VIEW 3.0 ROM	**£48**
VIEW PROFESSIONAL	**£79**
HI-VIEW (for use with 6502 2nd Processor)	£36
VIEW Printer Driver Generator (Please specify Disc or Cassette)	£9
VIEWSHEET (Acornsoft)	£36
VIEWSTORE	£36
VIEWSPELL with 80 track disc	£29
VIEWPLOT Disc (Please specify for Master 128 or Compact)	£20
VIEW-INDEX	£12
OVERVIEW Packs 1 & 2 for the Master	£72

Watford's own Sophisticated VIEW PRINTER DRIVERS

Epson FX80 & Kaga KP (Disc)	£8
Juki & Brother HR15 (Disc)	£8
Silver Reed Printers (Disc)	£8

ADVANCE COMPUTER PRODUCTS' ROMs

Adv. Disc Toolkit	£29
Adv 1770 DFS for Mast/Compact	£29
Adv 1770 DFS for BBC/BBC+	£29
Adv Disc Investigator	£24
Adv. Control Panel	£29

MINI OFFICE II

DISC Version for BBC B & B+	£14.00
DISC Version for BBC Master	£16.50
ROM Version	£43.00

(When ordering please specify for which Micro & 40 or 80 track Disc).

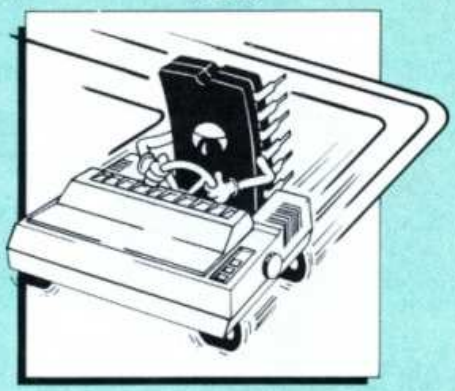
REPLICA 3

This new improved REPLICA 3 from Clares is a very powerful disc based TAPE to DISC Utility. It now transfers even more programs than ever before. Replica 3 will not work with all programs but then neither will anything else. 30,000 Replicas have been sold to date. It has to be good.

£15 (40 or 80 track)

Acorn's Speech Synthesiser package, complete
Special Offer £18

VIEW PRINTER DRIVER ROM



View is a powerful word processor, but until now has seriously lacked in terms of printer support. With the launch of our Printer Driver ROM, which includes an extremely powerful and easy to use Printer Driver Generator, View users can find themselves in the realms of advanced word processing only at a small outlay.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, Panasonic KX-P1081/2, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features).

NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redefinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute * command when printing.

Other features include a very powerful on screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips. (Write in for a detailed leaflet).

Price: Only £33

Harness the full potential of your Epson RX or FX printer. The NLQ ROM makes Epson printers produce Near Letter Quality output with optional proportional spacing, enlarged and underlined. Accessed by simple * commands from Basic, Wordwise and View (with driver) or almost any other language.

(Send an SAE for sample printout)

Only: £25

VIEW PRINTER DRIVER for NLQ ROM £7

DUMPOUT 3

A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including full Mode 7 graphics.
Also provided are window setting utilities and OSWORD calls to plot and read Mode 7 graphics pixels.

Facilities:

- Vertical and horizontal scaling in all graphics modes and mode 7
- Rotation of image by 90, 180 or 270 degrees
- Left hand margin setting
- Screen dump window setting
- Colours appear as grey scale
- Two tone fast dump
- Colour mask
- Mode 7 contrast expansion
- Mode 7 contiguous dump
- Key triggered and User Port triggered dumps

The Micro User Feb. 1985.
'Without reservation I wholeheartedly recommend the Dump Out 3 ROM as the ultimate screen dump facility for the BBC Micro . . . it must represent excellent value for money and surely cannot be beaten".

For use with the following printers:
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(The First & still the Best)
Supplied with over 25 Different fonts

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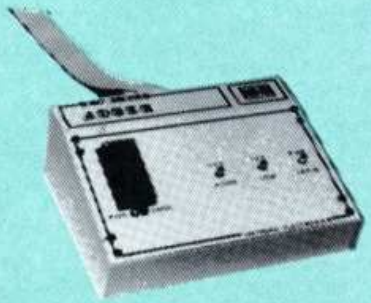
Supplied with disc containing over 25 example fonts. (Please specify 40 or 80 track when ordering.) Fonts are: Italic, Courier, Courier Italic, Script, Copper Plate, Shadow, Bold, Double Print and Gothic etc. (P.S. This ROM is not suitable for Epson printers.)

- NLQ Designer ROM, FONT Disc and Manual **£25**

(Write in for further details on all above ROMS)

ADDER



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- Automatic disc buffering to allow programming of 32K 27256 devices from a 32K file without extra effort.
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- Works with all standard filing systems. Generates header code for RFS ROMs to allow Basic programs etc. to be stored in EPROM. More than one file per ROM permitted.
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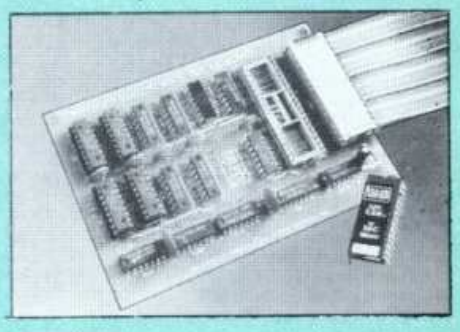
32K

SHADOW RAM- Printer Buffer Expansion Board



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(Price includes a comprehensive manual and the ROM)

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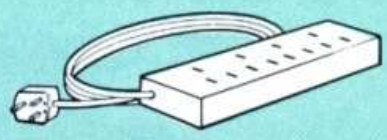

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Alpha Computer Co, Shop 314 Chi Fu Commercial Centre, Chi Fu Fa Yuen, Hong Kong. Tel: 5-506592.

Computer Distribution Company, Parklaan, 47, 8-9300 Aalst, Belgium.

E.B.N., Elisenstrasse 13, 1000 Berlin 41. Tel: (030) 7952057

Lendac Data Systems, Unit 31, IDA Enterprise Centre, Pearce Street, Dublin 12. Tel: 710796.

Lindis International Ltd, Wood Farm, Linstead Magna, Halesworth, Suffolk. Tel: 098 685 476.

Scientex P.V.B.A., Zilversmidstraat 2, B-2000 Antwerpen, Belgium. Tel: 03 233 59 06

Techno-matic Data, Holbergsgade 19, 1057 Kobenhavn K, Denmark

*Velobyte, Scheaedyksadyk 5a-6a, 3011 EB Rotterdam, Holland. Tel: (010) 413 8197/414 5171.

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£1600

win Masses of Midi Hardware and software in our Mega competition

The hardware was very kindly donated by Casio, Roland, Yamaha, Hybrid Technology U Music and Cheetah Marketing to form form one of the biggest competitions ever in A&B Computing!

We have a **Yamaha FB01** Sound Expander

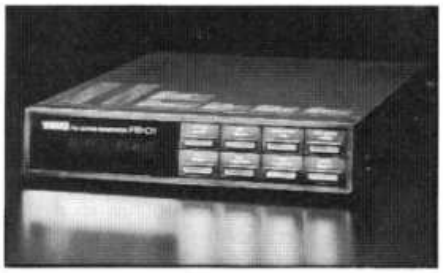
The **UMI-4M** sequencer for the BBC B/Master (as reviewed in this issue).

The **Casio CZ-230s** Synthesiser – with built-in drum pads!

The **Cheetah MK-5** master keyboard

The **Roland MT-32** sound expander and the **Music 2000** MIDI interface (reviewed in this issue)

All we are asking is for you to answer a few short questions, or, if you want to win the Music 2000 MIDI interface simply send in a Music 5000 composition.



Here's what you have to do.

Just answer the boxed questions below, tick the prize you would like to win, and tell us why you would like this prize! Simple isn't it!

Get your thinking caps on – here we go!

1. What does MIDI stand for?
2. When was it first developed?
3. Who were the inventors of the MIDI standard?
4. How many revisions were there made to the MIDI standard?
5. Name the three types of MIDI socket?
6. Which Rock act have used UMI in the past, is it a) Alan Parsons Project, b) Frank Zappa c)Rick Astley?
7. How high do the RSM grades examinations go?
8. What does ADSR stand for?

Alternatively

If you just want to win the **Music 2000** Interface, simply send in an original composition on a 40 or 80 track disk along with the entry form **BUT DO NOT ENTER THE EIGHT QUESTIONS**.

All entries must reach us by: **6th June 1988**. No correspondence may be entered into, and the judges decision is final.

All Music 5000 entries will be considered by the panel of Judges, if you wish to have your disk returned, please enclose a Stamped Addressed Disk Mailer with your name and address *clearly* marked on the front of the mailer.

Neither the judges nor ASP claim responsibility for entries lost, defaced, damaged, or otherwise lost in the post.

Name: .....

Address: .....

I would like to win the:

- ☐ UMI-4M
- ☐ Casio CZ-230s
- ☐ Yamaha FB01
- ☐ Cheetah MK-5
- ☐ Roland MT-32 or the
- ☐ Music 2000 MIDI interface

Because: .....

.....

.....

All entries for the MIDI competiton of a lifetime are to be sent to **MIDI Competiton, A&B Computing, No 1 Golden Square, London W1R 3AB**. *Photocopied entry forms will **not** be accepted.*

Darrin Williamson

MIDI AND BEYOND

Beyond the Sequencer

So you've got your sequencer package, you're happily keying in glorious compositions and in turn your micro is remembering and playing them back on whatever you played it on. All well and good but a bit restrictive sonically as the chances are your input device will play back all the parts using one voice. Even if your set-up allows different voices for different parts the whole piece is likely to sound very synthetic and dry, not through any fault of the user or indeed the piece of music but because the sounds used are artificially generated and never actually exist as sounds until after the piece has been recorded.

This may not seem like a big problem at first and for many users it may not prove limiting at all but as soon as you begin to take computer music seriously you'll find that straight compu-sitions will lack that slick production that our ears are now accustomed. At this point I can hear the sound of many brains switching off as the vision of hooking a humble little Beeb up to a multi-million pound multi-track studio whitters away every penny you own, leaving you in debt for several decades.

Fear not! Thanks to the modular magic of MIDI you can produce some very professional sounding compu-sitions on a relatively small budget. All you need is a few little black boxes and a handful of 5-pin DIN leads. Allow me to explain . . .

Sounds Around

As I've already mentioned, the chances are that initially you will be highly restricted in your pallette of sound sources. The BBC, although competant at generating sounds particulally with hardware assistance lacks some of the sonic quality of a stand-alone synth.

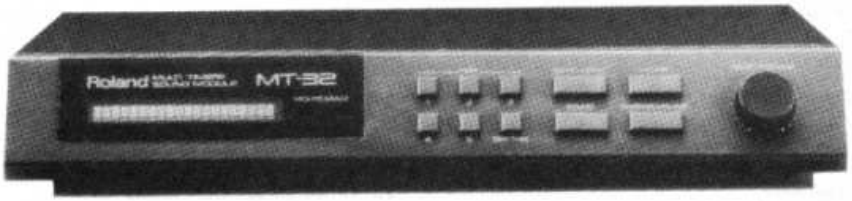
Until recently the only solution to this was the space and money consuming process of buying additional synths. This is rather impractical as you don't need dozens of keyboards all over the place. The solution is synth modules; the sound generaton circuitry of a synth without keyboard and performance controls which can be triggered via a MIDI keyboard and/or sequencer. Not surprisingly it's the Japanese music moguls, Roland and Yamaha that so far dominate this market. Yamaha have two budget units in their range. the first is the FB-01 which sells for between £200 and £300, depending on where you go and how hard you heckle. This unit provides some very nice sounds but is restrictive in as far as you cannot program the sounds which may or may not be a limitation depending on whether you intend to spend a lot of time trying to create your own sounds.

Moving on a bit in both price and flexibility we find the Yamaha TX81Z retailing for about £400. This unit does feature programmability and is housed in a 1U high 19" rack mounted unit. Both these units suffer from one problem in that you only have eight voice polyphony so if you want eight different sounds all active at the same time each sound will have to be monophonic, so chords are out I'm afraid. The only way around this is to sacrifice numbers of sounds so if you wanted four part chords you could only have five different sounds running at the same time.

Roland have come to the rescue on this point with the MT-32 which costs £450 and is designed specifically with the sequencer user in mind. Like the Yamaha models. This also allows eight different timbres at the same time but is 32 voice polyphonic so you can quite happily run all eight timbres and play each polyphonically. Furthermore the MT-32 has a built-in digital reverb and the 30 sound samples from the latest Roland drum machine the TR-626 so you can allot one of your sequencer tracks to playing purely the drum part and save yourself the expence of a drum machine. all the above units have 128 sounds and in general consist of imitations of orchestral sounds (strings, brass, bass, piano etc) although all three units offer some very nice, distinctive sounds of their own. So which has the best sounds, well there are no simple answers to this, it's really just a question of listening to all of them for yourself, although my personal favourite is the MT-32.

Sampling Delights

Sound Sampling differs from synthesis in that with sampling you "record" a sound by coverting it into numbers and then playing back the numbers, converting them back into sound. A good introduction to this process is the Barry Box (reviewed by Clive Grace back in the June 1986 issue). However, for musical applications, far more sophisticated units are required which, again are MIDI driven. The Akai S900 and the Roland S-50 have the lions share of this market although both machines retail for around £1500. Not to worry though, both manufacturers have



The Yamaha TX81Z represents a cost-effective way to get pro sounding synth patches.

Pick of the Pops – eight synths, a drum machine and a reverb unit in one little box.

All the effects you can think of and no bigger than a chocolate box.

produced models under the £1000 mark. However this still makes sampling something of a luxury.

FX

Now you've sorted out a barrarge of sounds it's time to mess about with them. The most important "effect" for electronically created music is reverb, which for those who don't know is a sort of complex, natural sounding echo or reverberation, which gives any sound the illusion of having been played in an ambient room which gives all your "acoustic" sounds a less sterile feel. Just recently we have seen a revolution in Digital Reverb. Prices have just kept falling and falling to the point where you can now get a reasonable selection of reverb treatments (short, long, gated and reverse) for about £150. However the added advantages of MIDI do add something like £50 to the price of a unit.

Alesis (distributed in this country by Sound Technology) have pretty much cornered the budget reverb market with the Midiverb which as released a couple of years ago. This model has 64 presets (which is enough for most people) and all of these can be called up by a MIDI patch change, in other words you can transmit a program change from your input device which changes the reverb treatment. Since it's launch the Midiverb has been superseded by the Midiverb II which gives you 99 presets. Not just straight reverb effects but variations on a theme like echo etc. The Midiverb II costs £299.

Simulating a room, however is just one treatment you can give a sound. There are all manner of different ways of squashing, stretching and delaying sounds to make them more interesting. Several manufacturers produce units that store all the effects that you're likely to need in one convienient box. Most of these units are now MIDI controlled which, again allows patch changing. Many of these effect units also allow MIDI triggering of effects where audio triggering proves too slow to be useful. Yamaha lead the way here with the REX-50. This has 30 preset effects ranging from reverbs of various types to delay, pitch change, compressor, chorus, symphonic, flange, phase and distortion effects, which pretty much covers all eventualities. The other nice facility is that all the effects are totally programmable so you can customise any one of the 30 effects and store it in one of 60 user-definable memory locations.

Rex's big brother from Yamaha is the SPX-90II which does pretty much every thing the REX-50 does (bar Distortion) but offers very basic sampling facilities which is a good way to get into sampling, although this unit shouldn't be bought just for this feature.

I got Rhythm

Percussion is an important aspect of most forms of music nowadays. Dedicated sound packages exist for the Beeb but a much better way of tackling the problem is to use a Drum Machine which gives your finished compu-sition better quality and a better variety of drum sounds. Most sequencer packages will give you the option of syncronising a beat box to it. So effectively the sequencer will take it's timing from the Rhythm track (just like in real life!). This will also give you the benifit of having spare sequencer memory for your tune. There are literally dozens of different drum machines for the budget-minded. Roland TR-626, Alesis HT-16, and the Yamaha RX11 are just a few of the units on offer. All of these feature sampled drum voices and have both real time and step time programming modes. Some models will allow you to enter the drum voices from a MIDI keyboard which may well give the added advantage of touch sensitivity which can really make a drum pattern come to life.

Cheetah Marketing have gone one step further and added a set of five dedicated drum pads to their digital drum machine. The total package price for these two units is £300 (£140 for the MD8 drum machine, £160 for DP5 drum pads).

And There's More!

That's just the start of what you can do with MIDI, as it is just numbers being pushed through a serial comms port there's plenty of scope for gadgets that collect these numbers, manipulate them and spit them out again in their modified form. Theoretically there's no limit to what you can do to MIDI provided you have the right hardware. New features

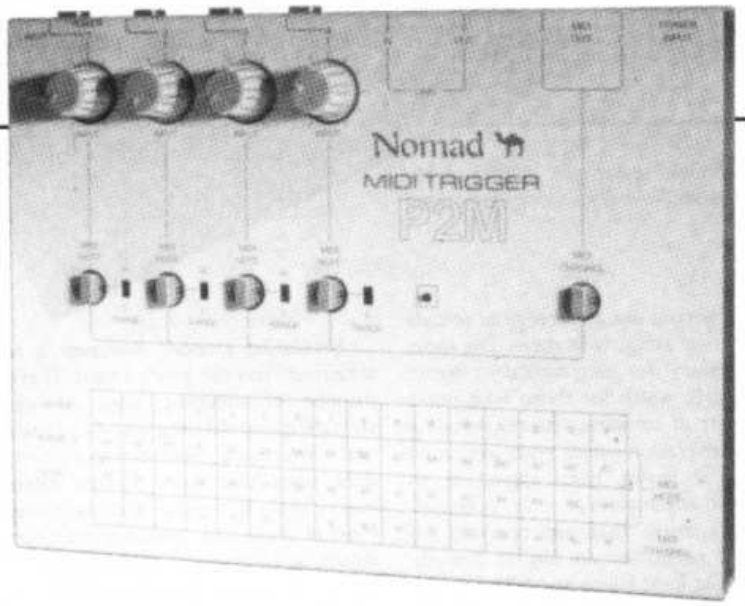
What a combination – the Cheetah MD8 Drum Machine and the DP5 Drum Pads.

can be added and unwanted features can be filtered out.

Akai have produced two wonderful units; the MB76 gives you the ability to set volume levels of various instruments which can be stored and called up a MIDI patch numbers. The other does the same kind of thing with tone (or equalisation) settings. The PEQ6 behaves pretty much like six graphic equalisers which, again can be set, stored and recalled via MIDI. The combination of these two units gives the user, in effect a spare pair of hands which would normally be needed on a mixing desk of some kind. You also have the added advantage of speed as MIDI can do things alot quicker that us mere mortals.

In conjunction with a sequencer these units are of great use in a number of ways. Firstly the Mix Bay can be used to mute instruments that are not needed for both verse and chorus. You can also vary the volume levels within pieces (gradually bringing up the volume of an instrument to achieve a "big finish" to the song). The PEQ6 can also do some magical things particulally if you're swapping instruments around alot in a piece. Each set of instruments can have there own set of tone treatments which can be called up at the same time as the sounds themselves. All that is required is leaving a sequencer track spare just to put patch changes on which will drive units like this as well as all the effect units I mentioned earlier. The MB76 and the PEQ6 retail for about £300 a piece.

Also in the Akai range is a MIDI patchbay (the ME30P II) which allows any of eight MIDI inputs to be routed to any or all of eight MIDI outputs which saves a hell of a lot

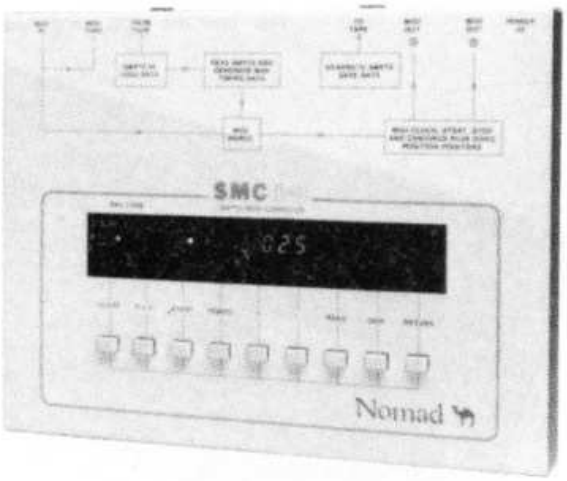


Nomad's P2M – the fastest trigger in the west.

of hassle (not to mention wear and tear on the equipment) out of the recording process. Yamaha also manufacture a patchbay which appears to be somewhat similar in spec. Both units retail for between £100 and £200. Yamaha also produce a product called an MCS2 which is a MIDI Control Station which gives you all the performance controls you could possibly want. This is especially useful if you input device is lacking a few controls in this department which is very often the case with older or cheaper MIDI keyboards.

Hertfordshire-based company Nomad have brought to these shores two pretty nifty little gadgets for the MIDIphile. The first is an audio to MIDI trigger interface which converts, say a drum beat into a MIDI code so if a friend of yours insists on playing live drums you can take the audio signal and convert it into a stream of MIDI codes which could be fed into your drum machine. The P2M costs about £150. Nomads armory of products also include the SMC 1.0 which converts MIDI codes into SMPTE (Society of Motion Picture and Television Engineers) codes which allow very accurate synchronisation to a tape machine which is extremely useful if you intend to link your sequencer to a multitrack recorder at some stage.

As you can see, MIDI opens up a whole wealth of possibilities to both professional musicians and the home enthusiasts. Contrary to what some "real musicians" may say, MIDI isn't just a cop out for people with no musical talent but a means of extracting what talent in the individual and exploring it to the full.



Remember! Timing's everything with the SMC 1.0 from Nomad.

Factfile

- **Akai (UK) Ltd, Haslemere/Heathrow Estate, Silver Jubilee Way, Hownslow Middx ☎ 01-897 2487**
- **Alesis, Sound Technology plc, 6 Letchworth Business Centre, Avenue One, Letchworth, Herts SG6 2HR ☎ 0462 480000**
- **Casio UK ltd, Unit 6 1000 North Circular Road, London NW2 7JD ☎ 01-450 9131**
- **Cheetah Marketing Ltd, Norbury House, Horbury Road, Fairwater, Cardiff CF5 3AS ☎ (0222) 555525**
- **Nomad Ltd North Road Farm, North Road, Wendy, Nr Royston, Herts SG8 0AB ☎ (0223) 207770**
- **Roland (UK) Ltd, 983 Great West Road, Brentford, Middx ☎ 01-568 4578**
- **Yamaha-Kemble, Mount Avenue, Bletchley, Milton Keynes MK1 1JE ☎ 0908 71771**

Archimedes COMPUTING

Workers Playtime!

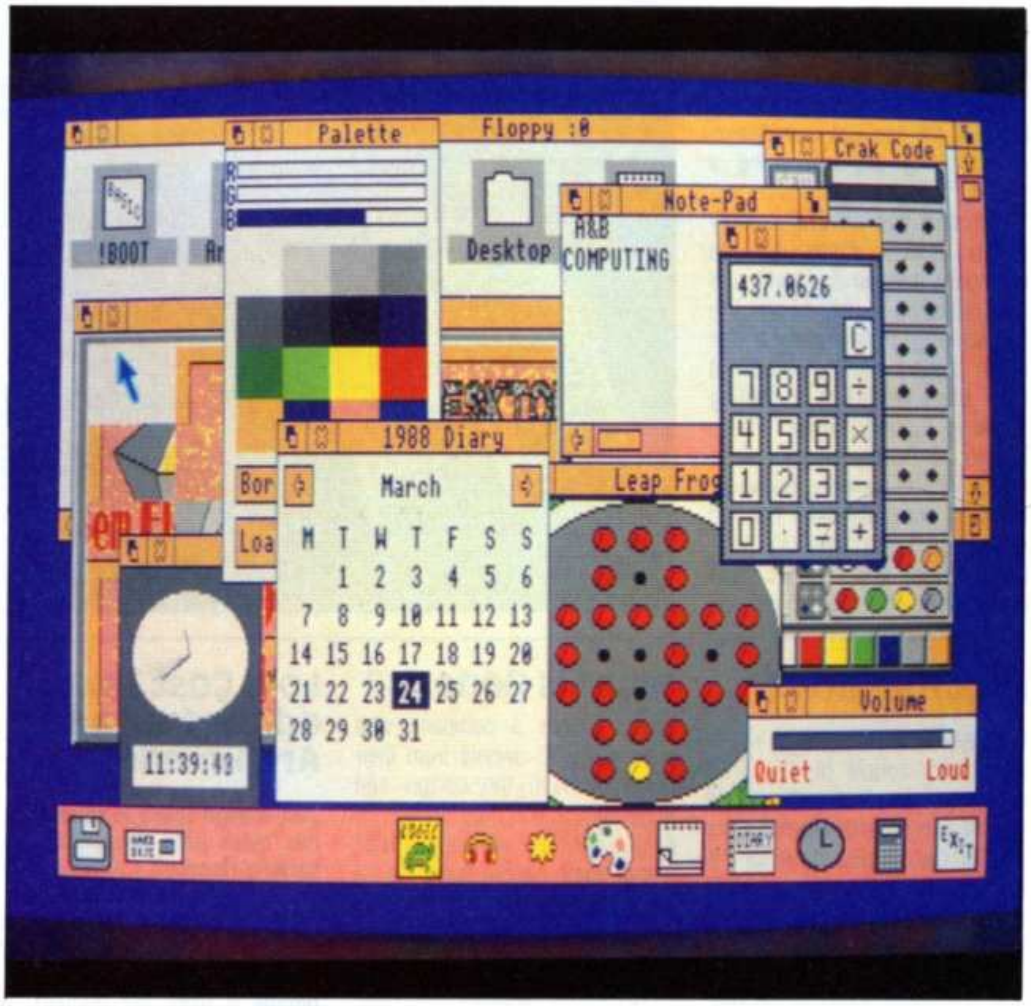
GEM Electronics have just launched a disc of executive toys for all versions of the Archimedes (bar the A305) which runs as an extention to the Desktop.

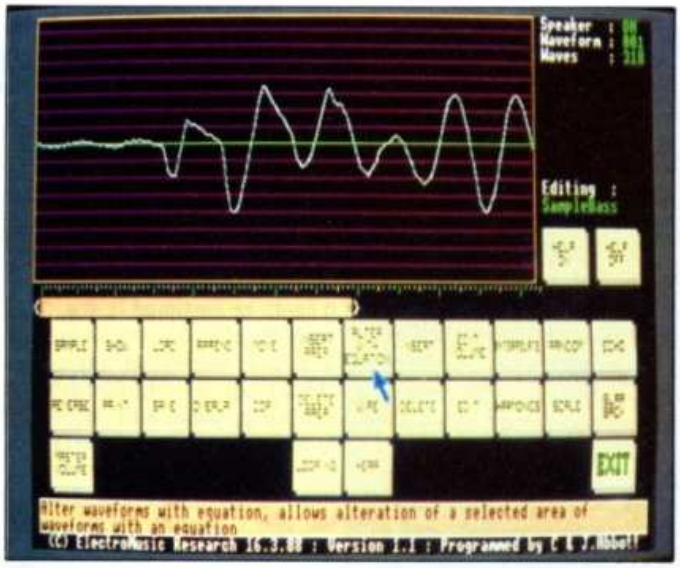
Three games and two utilities are included on the package: *Crakcode* which is a version of the board game *Mastermind* (you remember, the one with the little coloured pegs), *Leapfrog* which is a version of Solitaire and *Sliders* which is a basic 4x4 or 5x5 sliding block puzzle.

On the utilities front, you are given a volume slider control which, not surprisingly gives you control of the overall volume of the machine (at last).An Operating System or "*" command can also be entered without leaving the desktop.

Desktop Games costs £5.95 and is available now.

Contact GEM Electronics at 14 Tandagree Road, Portadown, Craigavon, BT62 3BQ.





Soundsynth – The shape of music to come?

Electro Music Research (or EMR) have been producing musical products for the Beeb for almost as long as Acorn have been producing the machines themselves. Whilst the likes of Hybrid and UMI continue to do wonders with eight bits, EMR have forged ahead into the world of 32 bits, with the mighty Archimedes. In fact it was EMRs dedication to the world of Micros and Music that must have prompted Acorn to endorse their wares as the official musical products for the Arc.

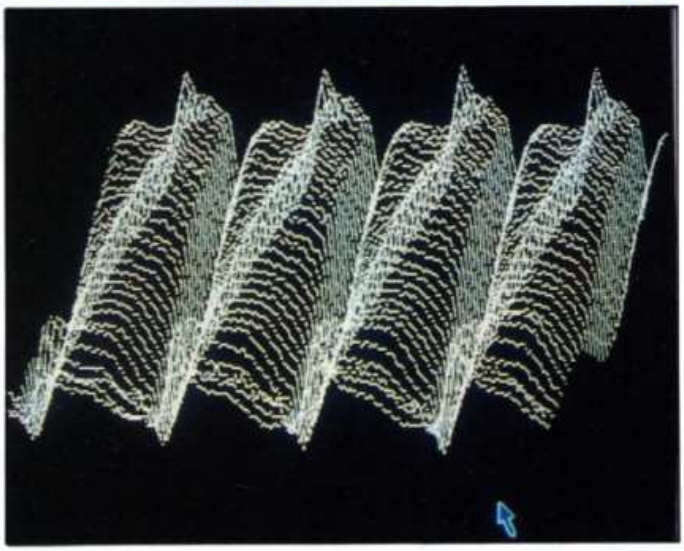
EMR plan a whole range of integrated music packages and utilities under the umbrella title of the Arpeggio Music system. Hardware and software modules will include composing, editing, mixing, sampling and teaching music. Many of these packages will be MIDI driven and will therefore require the forthcoming MIDI podule for the Arc Backplane. However *Soundsynth* is one of the few that won't require MIDI as it is a package designed to harness the internal sound capabilities of the Archimedes, which says a lot of EMRs faith in the Arcs sound chip. ▶

Sound Control

On loading up the package you are greeted with a control panel style screen which looks and functions impressivly. Mouse fans will be pleased to know that practically all the functions are controlled by pointing and clicking. The only keyboard entry is numerical input for waveform equations and timing/pitch tweaking using the cursor keys. The screen layout is very logical with the top portion of the screen set aside for waveform display with the lower portion given over to 30 "buttons" which give you pretty much all the possible permutations of stretching and squashing a sound.

To start you off EMR supply eleven sounds which can be loaded up, messed about with and resaved using a new name. The sounds range from a quaint a little organ sound entitled Medieval (very Black Adder) to a swirling synthetic sound called Phase (Tangerine Dream eat your heart out!). Once in memory the waveform is displayed and can be played from the QWERTY keyboard across four octaves (and presumably via MIDI once the podule is ready). Harmonics can be altered, sections can be inserted and/or deleted and various Echo and Slapback effects can be incorported. Furthermore if you're stuck for sound ideas you can put *Soundsynth* into random mode which will project a new waveform for you mess about with.

SoundSynth sets out to harness the sound capabilities of the Archimedes and does this job admirably however it doesn't stop there. With additional hardware in the shape of the *EMR A448 Sound Sampler* you can load in real sounds from the outside world and reshape them in a similar way. Sounds can then be imported into the Waveform Filing System for use in other EMR applications such as the sequencer packages so you will be able to trigger both MIDI sounds and internal sounds giving you a huge arsenal of sounds for your compu-sitions.



Factfile

- **Soundsynth from Electromusic Research costs £49.95.**
- **The A448 Sampler retails for £129.00**
- **Electromusic Research Ltd, 14 Mount Close, Wickford, Essex SS11 8HG ☎ (0702) 335747.**

External drive

CJE Micros have come up with a very clever couple of disc drive cables for the Archimedes. It is becoming more and more apparent that an add-on disc drive for the Archimedes has to be a 5.25" drive. Although in the perfect world software would be available on both formats, the 3.5" is not as well supported, either in the BBC or PC world, as it could be.

CJE's external drive cables (price £30.00) are fully buffered and require no soldering. A further thoughtful accessory, especially for users of the PC emulator, is the drive select translation cable. This changes the drive select lines so that an external drive with its links set for drive zero can be accessed as drive one. There are two types, one swapping 0 and 1 with 1 and 2, the other swapping 0 and 1 with 2 and 3. Cables are priced at £9.00, the switch at £8.00. CJE also have DFS reader software for £15.00.

Details from CJE Micros, 78 Brighton Road, Worthing, W.Sussex BN11 2EN. ☎ 0903 213361.

What is Genesis?

Tecnation are a company well known to BBC owners from their involvement in the design and programming of Stop Press for AMS. They are currently advertising their involvement in a project called Genesis for the Archimedes. It is described as "an ultra fast and easy to use 4D Imagination Processor". We await the results with interest.

Low Cost Text editor for the Archimedes

Just enough space to squeeze in this quick little news item regarding Hopesoft's Architext **– a text editor for the Archimedes.**

Other than that, there isn't a whole lot to say aboyt Architext, it doesn't use the desktop (although it uses the mouse), it supports mode 19, edits BASIC programs and has a function key strip, has up to five files open at once! But is certainly more straightforward than Arcwriter – Acorn's freebie word processor.

The package costs £19.90. A demo version costs £3.50 – you can claim this off the price of the package.

Contact Hopesoft at Hope Cottage, Winterbourne, Newbury, Berks, RG16 8BB. ☎ (0635) 248472.

Acorn release their own ROM card

In a move that is more than likely going to upset hardware/software house Computer Concepts, Acorn have decided to go it alone, and release their own ROM/RAM card for the Archimedes, directly competing with Computer Concepts older, and more established card.

The £59 expansion card will allow the 400 series (and the 300 with a suitable backplane) to accept 16K to 128K ROMS and 32K RAM chips, offering both native mode, and BBC emulation access.

The one big question is why? Perhaps Acorn have learned a few lessons after their policy of not releasing ROM boards had most certainly lost them a few pennies – after all, we never saw the Acorn ROM board for the BBC B, or the Acorn Shadow RAM board (other than those integrally fitted into the BBC Plus and Master Series).

The Acorn ROM card for the Archimedes will be available from all Acorn dealers or direct from Acorn themselves at: *Cambridge Technopark, 645 Newmarket Road, Cambridge, CB5 8PD.* ☎ (0223) 214411.

Small is beautiful

Although this utility is only small, it is an extremely useful extension of the ADFS and is recommended to anyone whose discs are getting cluttered or confused. Its main purpose is to list files (because that is most useful) but it could be amended to say, *EX each directory as it is entered – this one instruction replacing almost all of PROCDirectrify. Another possible amendment is to make the program generate a tree structure for the disc, rather like the examples included in the ADFS tutorial on the Welcome Disc.

Archimedes ADFS Search Utility

By Rick Hughes

The Archimedes "hierarchical" ADFS has many advantages over its BBC DFS predecessor, notably the number of files that can be stored on a disc and the way that files may be grouped together in directories, which may themselves contain directories. Thus the structure of a disc is that of a tree, with a "root" directory, $ and "branches" leading from there to all the files of the disc. Some of these files may have fairly lengthy specifications; the Welcome disc contains a file whose full name is $.Fonts.Corpus.Medium.IntMetrics, for example. After a few days of using my Archimedes another aspect of the ADFS became apparent – how easy it is to lose a file somewhere on the disc only to find it buried about three directories down from the root. (Notice by the way how the analogy with a tree soon gets inverted so that we refer to "levels" and "going *up*" to the root directory – shouldn't it be *down*?)

It is certainly no easy task to quickly locate a file somewhere on a stack of discs as a *CAT by no means gives the full story. The program described here is designed to get over this problem and it will list *all* the files on a disc together with their types (BASIC, Font, ASCII, etc) and their parentage – ie the path from the root directory by which they may be accessed. It has proved to be invaluable in use with my Archimedes and it is well worth spending half an hour or so typing it in.

Description

The program is written in BASIC and makes two SYS calls to read disc information. The resultant output may be directed to printer by activating it with a <CTRL B> before running the utility or by amending the program to do a VDU 2 before it starts printing.

After RUNning or CHAINing the program, you are prompted to load the disc you wish to catalogue and having done so, you should press the <SPACE> bar.

The number of ">" signs preceding the directory name indicates the depth below the root directory which will be the only directory with only a single ">".

Finally, the total number of files (not including directories) is printed out at the end.

How it works

Having mounted the disc, the program calls the OS routine "OS–GBPB" to read the disc name (and with it the "OPT" setting for the disc). Once these have been displayed, the program proper can start. Readers who are familiar with game theory will recognise the method of "tree-searching" adopted by the program – this is the section of code in lines 330 – 520 (see Listing 1).

The root directory is assumed to be $ and is assigned a level number of 0; now having found a new directory, PROCDirectrify is called to process it. This routine finds all entries in the directory, some of which may well themselves be directories and those that are simple files are listed to the screen, counted and forgotten about. Now we attempt to go down a level – the level number is augmented (line 360) and we enter the first directory we find at the new level (Directrify has put them in the array File$), calling PROCDirectrify again to deal with it.

Eventually we can go no deeper because the directory we are in contains no sub-directories and we now go *up* by one level; the level number being decremented (line 410) – if it goes negative, we are trying to go up from the root and we have nowhere to go, so the program ends.

To ensure the success of this process we need to keep a list of pointers, one for each level, showing the sub-directory we are in at that level. These pointers are held in the array Pointer.

Notice that the first, or only, dimension for each array is 9, which means that the routine never expects to go deeper than 9 levels in its quest for files. If this is a problem, it is a simple matter to increase the 9 to anything you like. (But what on earth are you using your discs for?)

The actual work of finding the contents of each sub-directory is done at line 680 where the OS routine OS–GBPB is called to deposit the information into the area Buffer; before this information can be used it needs to be unscrambled and this is the purpose of the remainder of PROCDirectrify.

♦ LISTING ♦

```
   10REM >DiscSearch
   20REM (C) ASP 1988
   30ON ERROR GOTO 1420
   40*KEY1 EDIT M
   50MODE 0
   60VDU 14
   70DIM Buffer 3000,Wildcard
2,Dir 2
   80DIM
Dir$(9),File$(9,80),Pointer(9)
,Types(9,80)
   90
  100PRINT''"Disc Search
(Version 1.00)"
  110PRINT''"Insert disc in
drive 0 - <SPACE>";
  120*FX 15
  130REPEAT UNTIL GET=32
  140*MOUNT 0
  150SYS "OS_GBPB",5,0,Buffer
  160length=?Buffer
  170IF    length=0 THEN
  180      Name$="Untitled"
  190ELSE Name$=""
  200      FOR I%=1 TO length
  210
Name$+=CHR$(Buffer?I%)
  220      NEXT
  230ENDIF
  240option=Buffer?(length+1)
  250PRINT''''"         Disc
name: ";Name$;"
Opt:";option
  260
  270level=0
  280Directory$="$"
  290$Wildcard="*"
  300Dir=0
  310Files=0
  320
  330REM Start of
tree-searching code
  340OSCLI("DIR "+Directory$)
  350Dir$(level)=Directory$
  360level+=1
  370PROCDirectrify
  380Pointer(level)=0
  390GOTO 450
  400
  410level-=1
  420IF level<0 GOTO 540
  430*UP
  440
  450Pointer(level)+=1
  460Pointer=Pointer(level)

470Type=Types(level,Pointer)
  480IF Type=0 GOTO 410
  490IF Type=1 GOTO 450

500Directory$=File$(level,Poin
ter)
  510PRINT
  520GOTO 340
  530
  540REM It's all over
  550PRINT''"Total number of
files=";Files
  560VDU 15
  570END
  580
  590DEFPROCDirectrify
  600 PRINT''SPC(8-level);
  610 Path$=""
  620 FOR I%=0 TO level-1
  630   PRINT">";
  640   Path$+="."+Dir$(I%)
  650 NEXT
  660 PRINT"Directory:
";MID$(Path$,2)
  670
  680 SYS
"OS_GBPB",10,Dir,Buffer,80,0,3
000,Wildcard TO Z,Z,Z,Objects
  690 Start=Buffer
  700
  710 PRINT TAB(12)"Files: ";
  720 printed=FALSE
  730 I%=1
  740 WHILE I%<=Objects
  750   Name$=""
  760   Load=!Start
  770   Type=Start!&10
  780   Start+=&14
  790   REPEAT
  800     Byte=?Start
  810     Name$+=CHR$Byte
  820     Start+=1
  830   UNTIL Byte=0
  840   Start+=3
  850   Start=Start AND -4
  860   File$(level,I%)=Name$
  870   Types(level,I%)=Type
  880   IF Type=1 THEN
  890     printed=TRUE
  900     Files+=1
  910     PROCgettype
  920     Name$+=" "+Type$
  930     PROCprint(Name$)
  940   ENDIF
  950   I%+=1
  960 ENDWHILE
  970
  980 Types(level,I%)=0
  990 IF NOT printed
PRINT"..none"  ELSE PRINT
 1000
 1010 PRINT"   Subdirectories:
";
 1020 I%=1
 1030 printed=FALSE
 1040 WHILE I%<=Objects
 1050   Name$=File$(level,I%)
 1060   Type=Types(level,I%)
 1070   IF Type=2 THEN
 1080     printed=TRUE
 1090     PROCprint(Name$)
 1100   ENDIF
 1110   I%+=1
 1120 ENDWHILE
 1130 IF NOT printed
PRINT"..none"
 1140ENDPROC
 1150
 1160DEFPROCprint(Z$)
 1170 IF COUNT>70-25 THEN
PRINT TAB(19);
 1180 PRINT
LEFT$(Name$+STRING$(25,"
"),25);
 1190ENDPROC
 1200
 1210DEFPROCgettype
 1220 Type=(Load>>8) AND &FFF
 1230 CASE Type OF
 1240   WHEN
&FFF:Type$="(ASCII)"
 1250   WHEN
&FFE:Type$="(Command)"
 1260   WHEN
&FFD:Type$="(Data)"
 1270   WHEN
&FFC:Type$="(Utility)"
 1280   WHEN
&FFB:Type$="(BASIC)"
 1290   WHEN
&FFA:Type$="(Module)"
 1300   WHEN
&FF9:Type$="(Sprite)"
 1310   WHEN
&FF8:Type$="(Absolute)"
 1320   WHEN &FF7:Type$="(BBC
Font)"
 1330   WHEN &FF6:Type$="(Fancy
Font)"
 1340   WHEN
&FEF:Type$="(Diary)"
 1350   WHEN &FEE:Type$="(Note
Pad)"
 1360   WHEN
&FED:Type$="(Palette)"
 1370   WHEN
&FEC:Type$="(Desktop)"
 1380 OTHERWISE  Type$=""
 1390 ENDCASE
 1400ENDPROC
 1410
 1420REM Error handling
 1430ON ERROR OFF
 1440VDU 15
 1450ON
 1460PRINTTAB(0,30);
 1470REPORT
 1480PRINT" at ";ERL
 1490END
```

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Graphics Pack 1	DB03	DB17	DB37	DE01
Musician	DB06			
Mode 7 Utilities	DB12			
Adventurescape III	DB20	DB28	DB35	
Combat Zone	DB21	DB30	DB32	
Easy Font	DB26	DB39	DB44	
ADFS Menu		DB27	DB31	
Graphics pack 2	DB29	DB34	DB38	DE29
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Getting Into Assembler	DB61	DB62	DB63	
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Sideways RAM	DB67	DB68	DB69	
Pascal	DB70	DB71	DB72	
Adventure Special	DB73	DB74	DB75	
Graphics Special	DB76	DB77	DB78	
Skywatcher	DB79	DB80	DB81	
Online!	DB82			
Disk User One	DU1			

AVAILABILITY AND PRICE

Name	Product	40(small)	80(large)	Price
Global View	DB01	yes	yes	£10.00
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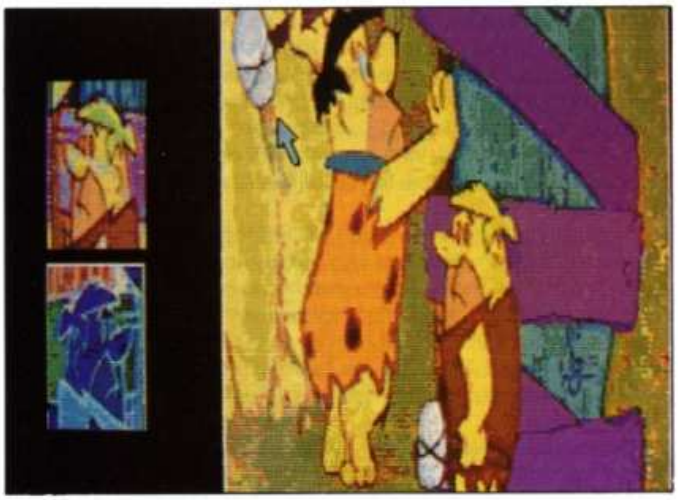
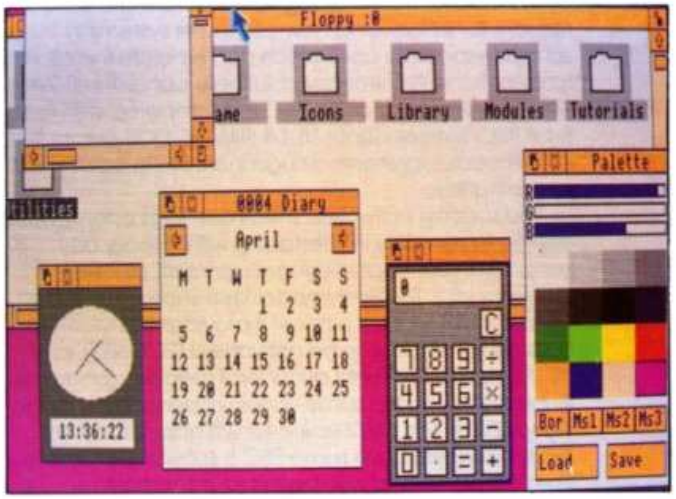




Is Archimedes a suitable computer for schools? And, if so, what worthwile software is available?

The Archimedes A series computers represent a quantum leap forward in technology as they use an ultra-fast, RISC (Reduced Instruction Set Computer) processor capable of *talking to* enormous amounts of memory, working at lightning speed.

My intention this month is not to talk about benchmarks or drystones or compilers which are of obvious significance for the programmer/enthusiast but to take a hard practical look at what the new technology promises for primary and secondary education.

In the face of stiff competition from RML and their capable MS-DOS (IBM's standard system) based Nimbus, education users have yet to be convinced of the realisation of the Archimedes' powers in terms of software. One of the criticisms levelled at Archimedes from educational circles is that little or no software is available for it.

Compared with the 3000 (education) titles available for the BBC B and 10000 (general) titles for MS-DOS machines, the Archimedes software does look a little thin on the ground. Criticisms have been levelled at Acorn and the BBC for encouraging development "down a cul-de-sac", away from IBM/MS-DOS business micros which some parties see as the emerging *standard* of computing in British schools.

Unfortunately, there are relatively few MS-DOS applications which are specifically educational. If educationalists are only concerned with training pupils to use business computers for jobs then there is some truth in the criticisms. If however, we are concerned about *education* then perhaps we should be exposing children to a variety of computer systems and software. After all, we should be educating our children to cope with change.

Acorn clearly state that Archimedes is aimed at higher education in the first instance. The £1000 price tag alone will dissuade many schools from purchasing one: two Master Compacts could be purchased for the same price. Archimedes' success in the primary and secondary sectors will depend largely on software developments which take advantage of the Archimedes's power.

In the long term, to simply try and run existing BBC software under the 6502 emulator is not good enough. *(The 6502 emulator is a piece of software which allows programs that would run on a BBC B or Master with a second processor or "Turbo" board to run on the Arc.)* We might as well continue using existing 8-bit computers although one argument says that if, for instance, a school has a number of BBC packages that will work on all their present machines, they may wish to extend their machine provision but still maintain uniformity of operation for older programs. This would especially be true where old machines were being replaced with Arcs. For this reason the likes of Longman and AVP have transferred all of their programs across to the Arc, either using the 6502 emulator or running *native* in the Archimedes own ARM BASIC V.

In addition to the 6502 emulator there is also the PC Emulator which makes the Archimedes behave like the MS-DOS machines mentioned above. This therefore means that users can run IBM software on an Archimedes – although it does work a little more slowly than the IBM. If there were also to be a Nimbus emulator this would give owners access to nearly all the major computer systems found in schools.

Business departments especially will benefit from this facility since they will now be able to run standard business packages such as Lotus 1-2-3 without the

need for another machine. Acorn and their distributors have told me that it is difficult to list what software runs under the PC Emulator – quite simply they have found very little that doesn't! Even home-grown and highly protected software still seems to run – a remarkable achievement.

New broom

Perhaps what is required for education is not only added sophistication but more forgiving software which has a far "friendlier" user-interface than is possible with existing software – as exemplified by RESOURCE's *Desk Top Stories* or Clare's *Artisan*. With the BBC B looking decidedly aged now there are valid reasons for introducing new computer systems in schools especially ones which can emulate the other runners! Is the Archimedes a suitable candidate? Will it enjoy the longevity of the BBC B? Compared with the 8-bit BBC/Master 128 or 16-bit IBM/MS-DOS computers, Archimedes represents a huge increase in power and performance.

The success of the BBC B was due to its open-ended design: its versatility in interfacing with virtually any peripheral (concept keyboards, printers, plotters, modems etc). The Archimedes also shares this design concept although at a price! It provides the facility to enlarge its memory, to be networked (ECONET), and by a system of optional peripheral modules (podules), to interface with the same variety of peripherals as the aged BBC B. The 6502 emulator will ensure that the Archimedes will have some BBC B software available from the outset and can be put to immediate use, for example *Read Right Away* – HS Software and the Longmans and Scetlander range.

Some Brickbats

After using an Archimedes for about three months there are one or two personal gripes I would like to air.

Firstly, the A305 (512K) is very restrictive and must at some point be upgraded to 1Megabyte of RAM. The limitations imposed on most software packages currently available are quite enormous. Thus if you are thinking of upgrading from your BBC B take note: you need an A310 at least! Software houses are trying to constrain their packages to run with only half a megabyte on the 305 but many of them acknowledge in their documentation that this severely restricts the facilities or power that they could offer. One adviser told me that he considered that the 305 was like the BBC Model A – "no damn use until you'd upgraded it"!

The problem with expanding an Archimedes is that it is very expensive to put on any peripherals other than a printer. I feel the backplane should have been included as standard on the machine but of course this would have raised the price.

The function keys are dissimilar to the Model B and Master making it rather confusing for children and adults alike when upgrading. The problem really is the fact that key f0 has disappeared. The keys now start at f1 and go up to f12.

To confuse matters further, the "Print" key (which doesn't do that incidentally) will often act as key f0 – but it's next to f12! If you are using View with the 6502 emulator your f0 commands are there as usual on the Print key.

A way is needed to plug in a 5.25" disc drive, or indeed a second external 3.25" drive, to allow BBC ADFS discs and MS-DOS discs to both run under their respective emulators without recourse to transferring to 3.5" format. One solution has been provided by Dudley Micro Services who have produced a very neat cable and interface for hanging an external drive onto your Arc. This device is fully buffered so that any problems with the drive will not affect the computer.

The manufacturere have thought carefully about problems with the system and have covered eventualities such as those drives which do not return a "Drive Empty" message to the computer when the disc is not present. This little device is excellent value at £25.95 and is a must if you want to use a variety of disc sizes. Why an external drive facility was not provided originally I am at a loss to understand.

The Desktop application is in ROM and is extremely fast. It is also in many ways an obstacle to computer friendliness unless its use is standardised throughout all software publishers' programs. If you are familiar with WIMP (Window Icon Mouse Pointer) systems on the Macintosh, Amiga, Atari (GEM), etc then you will appreciate the overlapping windows etc of the Acorn system. It provides you with a number of desktop-type tools which are available to you all the time through the system.

However, the current version of Desktop has many shortcomings: the diary is only available in the current year, the clock has no alarm and the calculator has no memory, square root function nor percent key! Both Brainsoft's and Minerva's disc-based desktops are superior. Why did Acorn bother to ROM the desktop? It only takes up valuable ROM space. To get rid of the Desktop type

***CONFIGURE LANGUAGE 4 CTRL+BREAK**

Your machine will now come up in BASIC and will behave in a similar fashion to your ordinary Master or B. (Acorn throw up their hands in horror at this point and say "We want you to use the desktop – not avoid it", to which we reply "It's only going to be useful when it makes life easier – that's up to the software people"). For the time being, without desktop your software will Boot up in the usual way – SHIFT/BREAK.

Final grouch. The whole idea of more powerful machines is to enable the user to do highly complex tasks without knowing that they are doing them. The ability for example to open two datafiles at once on Minerva's System Delta Plus is an extremely tricky operation which would normally need two computers. With that excellent package the user performs the operation with consummate ease.

Why then have Acorn omitted from their operating system some of the obvious "facilitating" tools which make life easier? Are we really going to have to write a piece of software to freeze the screen and print it at any time during a program with a simple keypress? Since ESM have been so successful with Screenprint for the BBC B it seems a logical facility to have as standard in the machine. Apple Macintosh has this type of function written into the machine's command language. How about the ability to save a screen, trace a series of keystrokes, backtrack one or two steps or call up the desktop at *any* point?

Having expressed some of the grouches, let me say that it is always easy to find something wrong. When all is said and done, Acorn have produced a very powerful and versatile machine. Now let's look at what you can do with it at the moment.

Getting Started

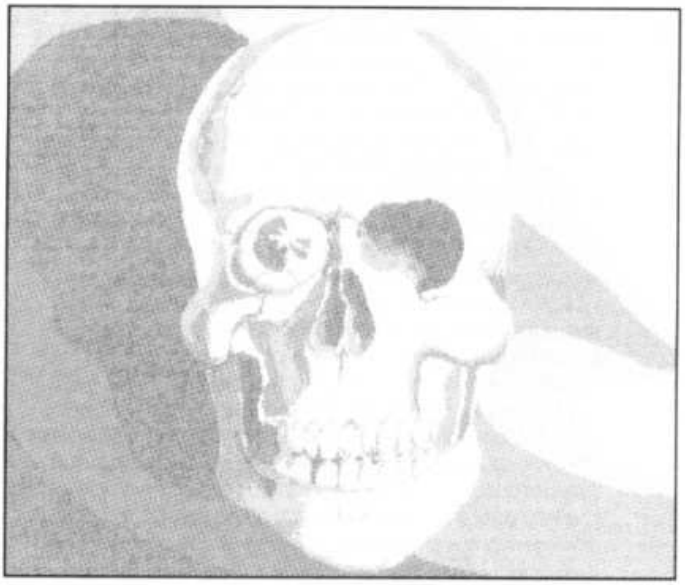
One of the first things you require after setting up the Archimedes is some means of getting BBC/Master files onto the Arc's 3.5in ADFS discs, assuming that you want to transfer some of your existing materials. This is most likely to be word-processor files in the first instance.

For DIY teachers, the file transfer article in the January 88 issue of A&B Computing works a treat but you must be prepared to spend a couple of evenings getting the cable made up and software typed in.

For those who are too busy and/or prefer an off-the-shelf package, *Disc Transfer Kit* from Brainsoft is a worthwhile investment. Everything you require is included in the kit. Utilising Brainsoft's own superb, customised desktop a BBC/Master becomes a terminal controlled by the Archimedes.

DFS or ADFS 5.25in discs are catalogued, files marked and transfers automatically take place while you make a cup of coffee. Files are correctly *SETTYPEd so the Archimedes can recognise the file when it is run from the desk top. Baud rates are also set from a window. The desktop features a full 40 function scientific calculator and Big Ben!

For an extra £5.00 a text editor is available for use with compilers. Up to 2000 lines of text may be edited and have two windows open on the text simultaneously. This low cost transfer kit can be thoroughly recommended.



Word Processors

The first item of content-free software required in the classroom is a word processor. Already the Archimedes has two suitable pieces of software, one of them 'free'. Gordon Taylor has already discussed ArcWriter in some detail in the March 88 issue of A&B Computing and I will not elaborate further here. Obviously, ArcWriter is only suitable for older pupils and for administration work. However, its WYSIWYG approach is understandable and a great improvement when trying to teach the use of control codes in documents.

Graphic Writer opens new word processing vistas. This too has been reviewed in the May edition of the magazine. From an educational viewpoint there is still a good deal to be said about this software. Graphic Writer was written to a particular brief and was one of the few packages that were actually commissioned by Acorn. (Quite why they then "adopted" ArcWriter remains a mystery.) At the time of its creation, not all facilities were available to allow for example the printing of the new fonts and point sizes of text.

Consequently Graphic Writer had to be something of a compromise between what Clares would want to write and what the machine allowed them to do at that time. They have undoubtedly maximised the potential as far as they were able.

Graphic Writer is excellent for schools for a number of reasons: firstly, it is window-based. If you have not seen how windows help the user to get the best from software then hurry along to your nearest Arc owner and ask to see Graphic Writer or Artisan. Secondly, it provides facilities to enable the integration of graphics in a document. These may be simply created using the package's own graphics editor. At any time you may switch between the two systems without saving and re-loading and you may draw in elements from other sources such as sprites created in Artisan to complement the material you are creating.

The question to be asked is into which area of school does this type of package fit? Graphic Writer is simple enough to be used by junior school children upwards but some of its facilities may be a little complex for the younger end of the age range. As a general purpose document creator it will take some beating. The ability for example to create a simple bar or pie-chart in a matter of moments, slide it onto a space in your text, preview it to see that you have done what you intended and to re-format page size and layout with a minimum of fuss.

The page layout is all done in reduced size with dots representing letters. The "shape" of the page is then seen clearly and page length can be adjusted by sliding rulers up and down the page. The system automatically re-formats the document.

I don't need to go into the arguments here of the benefits of word processors as a classroom tool. Readers of this magazine will have seen my comments on this before. It is worth stating that this package will provide the users with an even more friendly environment than was possible before. There is still room in the market however for a primary word processor on the Arc – preferably WIMP-based. The question will be whether authorities put the Arc into primary schools. If not, there is little market for such a package. This is the quandry facing many software publishers at present and perhaps explains the amount of software that is merely passed across from the B.

Primary Software

One of the first primary language packages to be transferred to the Archimedes was HS Software's Read Right Away compilation entitled *Bumper Pack-1*. The programs are exactly the same as those on the BBC B but with a noticeable improvement in speed. These programs run under the 6502 emulator so that they also perform identically to the BBC B versions. These phonics-based programs offer motivation and reading practice in the guise of some very appealing games.

Droom from RESOURCE is one adventure program that is guaranteed to grip 7 and 11 year olds equally – see Des Thomas's review in the November 86 issue of A&B. The adventure is based around a story in which the Princess Arminda has been kidnapped by the wicked dragon *Droom*, and Prince Henry, her true love has been turned into a frog. The children's task is to rescue Arminda and in the course of their adventure they encounter fairies, trolls, a witch and a wizard.

A story book sets the scene and introduces all the characters that the children will meet. There are two elements in the program: the story line which proves to be a rich source of inspiration for creative work and expressive work, and a series of puzzles and problems. It is on the solution to these that progression through the story depends. A supplementary puzzle disc is included to give children practice with the type of problems children will encounter.

Archimedes *Droom* impresses with stunning graphics in comparison with the chunky graphics of its predecessor. *Droom* is now fully mouse controlled using the WIMP environment and running in native mode. Thus animation is very smooth and fast and great improvement on the original. Everything in the BBC version is there in the Archimedes version but in a sophisticated form and with a few surprises!

Desk Top Stories is the Archimedes version of Fairy Tales on the BBC B. With this simple desk top publishing package children easily combine sprites (graphics which may be moved around screen without affecting the area of the screen that they cross) from a disc-based library with text to form pages of a 'book'.

A 'book' may contain up to 40 'pages'. A 'page' is one screenful of text, sprites and special characters. The disc contains a library of approximately 130 sprites which can be used to create sprites files which in turn are used to illustrate pages. Sprites are called up and moved over the screen using the mouse. Up to 200 sprites may be placed on a page; this is compared with only 11 for Fairy Tales. Sprites may be replaced or deleted at any time during page composition.

Text is presented in double height and in 64 colours. A second set of 26 special characters is available from the keyboard. These can be combined to depict almost any shape. Users can create their own sprites and save them as files to be called up at will. Any sprite may be superimposed on another and by clicking on an icon the former sprite becomes partially obscured by the latter.

The package utilises the full WIMP environment, and any page may be dumped to the printer. A choice of colour or monochrome dump is offered. In *Desk Top Stories*, RESOURCE have done a superb job. It is altogether a cleverly designed package which is immediately appealing to young children.

Logotron Logo

Finally free from the constraints of the BBC B's limited memory, Logotron's Archimedes Logo offers a superb Logo environment. Memory need never again be a constraint on recursive procedures – a theoretical maximum of 16Mb of node space is possible and a speed approaching 10 times that of BBC B Logo. The result is a truly realistic programming environment for Logo users.

Logotron Logo is almost totally compatible with the BBC version. It allows Model B Logo files to be run with no modification once transfered to the Archimedes format. Logotron claim that there will be support for a 1024 x 960 pixel graphics resolution with up to 256 colours on the screen in certain modes. A multiple-screen, turtle module is included on the disc.

Once installed it can control up to 32 turtles on screen at once. Two welcome additions are the option of a 132 column editor and the more powerful debugging environment offered (eg there are many more error messages). Over 90 new primitives are now available.

BBC B Logo extensions cannot be used with the Archimedes. There will be a number of modules released this year (Control Logo, 3-D Logo, Music Logo etc), each with enhanced performance over its BBC counterpart. These modules will be able to reside in the machine concurrently, allowing one or more to be used at any time.

Archimedes Logo provides an exciting and powerful environment in which children may explore turtle graphics and list processing. It also turns Logo for the first time with a BBC machine into a viable programming language now that it operates at a sensible speed.

A Real School's Experience

Loanends Primary School in County Antrim was probably one of the first primary schools to have an Archimedes on their premises. Pupils from the schools under the guidance of their teacher, Mrs Ruth Forbes, entered a competition with the Royal Mint which resulted in their winning an Archimedes system. Mrs Forbes writes of her experiences with the machine – alone and unaided: *"I feel I need a lot more time with the Archimedes. My first thought on being told that the school had won an Archimedes was that I could have bitten off more than I could chew! However, not one to be daunted by high technology, I took delivery of the Archimedes just after Hallowe'en 1987. I looked at the light, well-designed keyboard and the neat set-up of monitor and disc-drive and took a deep breath.*

The first Welcome Disc gave us some trouble as not all of the programs would come up – we were able to use some of them however to get the children used to the computer. We already have two BBCs in school so we had an easy transition to the Archimedes. We were very lucky to get one program "Droom" for the Archimedes and I can say it was a great success with the children. The graphics were superb and the children enjoyed all the puzzles leading to the capture of the dreaded dragon.

The art program included on the Welcome Disc was one of the best we have had. It was easy to use and has endless possibilities. I just wish we had a colour printer but we have a black and white Epson so I have ordered a lead to connect it to the Archimedes. (Ask for an IBM printer cable for an Archimedes – W.B.)

The mouse was fun to use and the children soon got used to it. They particularly enjoyed the desktop. For myself, I really could never see much difference between one computer and another. The Archimedes has been a different matter. I can appreciate the quicker reaction time, better program content and the superior graphics and sound. I think that over the next year when we have a variety of software we will be able to realise some of its potential. I think that we will never use the machine to the full in a primary school, but it may be that at the end of the year I may have to eat my words!" Mrs Forbes' experience is one which most schools are going to have in the early stages of Archimedes development. The range of materials available will grow as time passes, but initially the development process for new software on this

machine is greater than might normally be the case. Software houses are having to invest large quantities of time and money in the training of programmers, purchase of machines and establishment of library routines. Once that development phase is passed then, provided that Archimedes has lived up to its market expectations, we should see some interesting new ideas which exploit the machine's facilities.

Middle school and Secondary software

Many schools today embark on a "mini enterprise" with their pupils – in short, a small business(es) involving a whole class of children. The computer is typically used for DTP, word processing, spreadsheet work and of course banking. This latter application is frequently performed by a spread sheet like *Grass Hopper*.

Archimedes owners can take advantage of *The Bank Manager* from Contex Computing. Running in native Archimedes Mode 7, this software is designed as a banking program for home and small business use. Combined with the optional *Business Utility Pack* it is very comprehensive. What makes it particularly valuable for mini-enterprise work is *Bank Manager*'s simplicity of operation and the fact that it monitors up to 36 separate accounts. It can organise financial transactions and produce detailed reports on the state of the accounts. Up to 99 items which need to be budgeted for can be entered with a code. The codes can be used effectively to see what has been spent over periods from 1-360 days. Each account file can have its own password for protection.

If the school's Archimedes is used for administration then the Contex *Bank Manager* will provide all the facilities required for managing the school's accounts. It can even handle accounts in foreign currencies!

Art and Graphics

The Archimedes Welcome Disc contains a very capable painting program which can be exploited well in the classroom especially to introduce the mouse as an input device. You may decide that this program is all you will need. However, one item of software which really exploits the power and potential of the Archimedes is Clare's *Artisan* (see review in December 87 issue of A&B). It is far ahead of any art package on the 8-bit machines, yet you can run much of the package without any recourse to the manual.

Artisan epitomises software which is both powerful yet very simple to use : after all this should be the promise which Archimedes offers education. There are a number of features which really are quite breathtaking for those of us raised on 8-bit machines. The 2x, 4x and 8x zoom makes pixel editing very simple indeed.

Although working in Mode 12 with 16 colours on screen, a *magic brush* allows pixel dithering and up to a possible 256 'colours' to be created. The use of 'transparent' colours make sprites relatively easy to pick out from screens without obtaining any background colour. These can be filed in the sprite library. Those who possess an Integrex 132 colour printer have at their disposal the ideal means of obtaining hard copy from *Artisan*. The results are extremely good.
When you consider that *Image* from Cambridge Micro Software, a BBC B art package, for schools costs almost £50.00, *Artisan* represents excellent value for money.

Clares have also made the understanding of their system easy in Artisan by providing an option to have a constant "help" window on-screen which tells you what the functions are for any item at which you may be pointing. Please Mr Clare, can we have that same facility on Graphic Writer? Please, all other software houses, copy Clare's example if your software is at all complex!

Database Systems

The laborious nature of most database management systems until the advent of Archimedes has meant that users have not had facilities that are sufficiently powerful for anything other than fairly simple operations. For educational purposes this has often been sufficient power since the datafiles being handled have been small. If however you take a major datafile containing say 3000 records, the search and sort times are very heavy going unless there is a suitbale key field index.

On the Archimedes however, Minerva Systems have come up with an extremely powerful system, their *System Delta Plus Database Management System* which, despite its power and excellent facilities is so easy to "drive" that it literally takes a few minutes training to be able to handle the fundamental elements of the package. The more sophisticated aspects require not only an understanding of the way in which the package works but of course a general understanding of information processing. These facilities become more apparent as one gets more involved in use of the system. See the March '88 issue of A&B for a full technical review of the package.

Having shown this system to teachers on a number of courses I am now beginning to enjoy the moment when their eyes pop out of their heads as one datafile is opened and set "fast-forwading" through the card index whilst a second file is opened and searched in reverse. A third file might be opened and sent to the printer – all at the same time!

The real power of System Delta does not just lie in its management system however. It has a number of templates or ready prepared systems which can be bought for a number of business and administrative purposes. The School Administrator option for instance allows pupil and staff records to be kept with options to select data relevant for Form 7, produces analysis of data for examination entry and may be used for a number of internal administration functions. A timetabling option extends the power of the system.

Factfile

***Disc Transfer Kit* is available from Brainsoft, 22 Baker St., London W1M 1DF. Price £14.00 (add £5.00 for the editor).**
***5.25 Disc Interface* is available from Dudley Micro Services, 30 Hadley Close, Netherton, Dudley DY2 9JX (0384) 633142 Price: £25.00**
***Bumper Disc 1* is available from HS Software, 56 Hendrefoilen Avenue, Sketty, Swansea, SA2 7NB**
A. *The Bank Manager* B. *Business Utitities Pack 1* and C. *Typing Tutor* are available from Contex Computing, 15 Woodlands Close, Cople, Bedford MK44 3UE price : A. £25.00 B. £12.00 C. £12.50
***Read Right Away* is available from HS Software,**
A. *Artisan* and B. *Graphic Writer* are available from Clares Micro Supplies, 98 Middlewich Rd.,Rudheath, Northwich, Cheshire CW9 7DA, price A. £39.95 B. £39.95
***Datafile of eductional software – System Delta Plus format* from Nick Evans, PO Box 55, GRIMSBY DN32 0QB Price: £20.00**
A. *Archimedes Droom* B. *Desk Top Stories* RESOURCE Exeter Road off Coventry Grove Doncaster DN2 4PY (0302) 63800 Price : A. £18.95 B. provisionally £28.00
***Archimedes Logo* Logotron, Dales Brewery, Gwydir Street, Cambridge CB1 2LJ TELE : 0223-323656 PRICE : £60.00**
A. *System Delta Plus* B. *School Administrator* C. *Timetabling* Minerva, 69 Sidwell St, Exeter, EX4 6PH 0392 37756 PRICE: A. £69.95 B. £79.95 C. £T.B.A.
***Diagram II* is available from Pineapple Software, 39 Brownlea Gardens, Seven Kings, Ilford IG3 9NL 01 599 1476**
***Arctist* is available from Fairhurst Instruments, Dean Court, Woodford Road, Wilmslow SK9 2LT**

PINEAPPLE SOFTWARE

Programs for the BBC model 'B', B+, Master and Master Compact with disc drive

DIAGRAM II - now also available for ARCHIMEDES

Diagram II is a completely new version of Pineapples popular 'Diagram' drawing software. The new version has a whole host of additional features which make it into the most powerful and yet quick to use drawing program available for the BBC micro. The new features mean that 'Diagram II' can now be used for all types of drawings, not just circuit diagrams. Scale drawings are possible and the facilities for producing circles and rubber banded lines together with the pixel drawing routines make any type of drawing possible. This advert has been produced completely using Diagram II.

Summary of Diagram II features:-

1. Works on all model BBC computers and makes use of Shadow memory if poss.
2. Rapid line drawing routines with automatic joins for circuit diagrams.
3. Rubber band line and circle drawing modes.
4. Makes use of the Acorn GXR rom to produce ellipses, arcs, sectors, chords and flood filling.
5. Pixel drawing mode allows very fine detail to be added.
6. Defined areas of screen may be moved, copied, deleted or saved to disc.
7. On-screen cursor position indication allows scale drawings to be made.
8. Keyboard keys may be defined to print User Defined Characters allowing new character sets to be used.
9. Wordprocessor files may be loaded and formatted into defined areas.
10. Up to 880 UDC's if shadow memory available, 381 without shadow.
11. Compatible with Marconi Trackerball and most makes of 'mouse'.
12. All 'Diagram Utilities' are included.
13. Completely 'scaleable' print routines allow any area of the diagram to be printed either horizontally or through 90deg. in scales that may be varied in 1% steps allowing up to 18 mode 0 screens to be printed on an A4 sheet (still with readable text).
14. Smooth scrolling over the whole area of the diagram.

Diagram II consists of a set of disc files and a 16k Eprom. The disc is formatted 40T side0 and 80T side2. Please state if this is unsuitable for your system, or if you require a 3.5" Compact disc

DIAGRAM II - £55.00 + vat P & P free

MARCONI TRACKERBALL

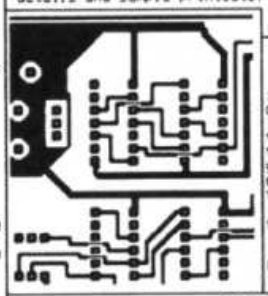
For Model 'B' and B+ (with Icon Artmaster)	£ 60.00	+ vat
For Master 128 (with Pointer Rom)	£ 69.00	+ vat
Bare Trackerball (no software)	£ 49.00	+ vat
Pointer Rom (available separately)	£ 12.50	+ vat
Trackerball to mouse adapters	£ 9.00	+ vat
Postage and Packing on Trackerballs	£ 1.75	

PCB

Pineapple's now famous PCB drafting aid produces complex double sided PCB's very rapidly using any model BBC micro and any FX compatible dot-matrix printer. The program is supplied on Eprom and uses a mode 1 screen to display the two sides of the board in red and blue either separately or superimposed. Component layout screens are also produced for a silk screen mask.

The print routines allow a separate printout of each side of the board in an expanded definition high contrast 1:1 or 2:1 scale. The print time is typically about 5 mins. for a 1:1 print of a 7" * 5" board. This program has too many superb features to adequately describe here, so please write or 'phone for more details and sample printouts.

£85.00 + vat Plotter driver to suit most plotters £ 35.00 +vat



PCB AUTO-ROUTING

This brand new addition to the PCB program greatly increases the power of the software and speeds the design of PCB's even more.

A list of up to 190 connections may be entered in the form of a 'rats nest' and then the computer does the rest! You may specify which side of the board you wish a track to be on or you may leave the choice to the computer, and you may also say whether tracks should be allowed to pass between I.C. pins.

The program is in the form of a second Eprom and full features are available on a standard model 'B.'

Please write or 'phone for full details.

COMPLETE AUTOROUTE PACKAGE (Including manual Eprom) £185.00 + VAT

ADFS Utilities Rom

ADU is an invaluable utility for all ADFS users. It adds over 22 new *commands to the ADFS filing system as well as providing an extensive Menu facility with over 35 sub commands covering areas such as repeated disc compaction, saving and loading Rom images, auto booting of files and many more.

Copying of DFS discs onto ADFS discs can be made in one pass with automatic creation of the required directories on the ADFS disc. All functions are fully compatible with Winchester drives including *BACKUP which allows backing up of Winchesters onto multiple floppies.

New *commands are as follows:- *ADU, *BACKUP, *CATALL, *CHANGE, *DFSADFS, *DIRALL, *DIRCOPY, *DIRDESTROY, *DIRRENAME, *DISCEDIT, *DRIVE, *FILEFIND, *FORMAT, *KILLADU, *LOCK, *MENU, *PURGE, *PURBRK, *UNLOCK, *VERIFY, *VFORMAT, *WIPE

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ARCHIMEDES
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- user-defined function keys
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ArchiText is available now, and we're so sure that you will agree that ArchiText is better than any other text editor that we're making this offer:

ArchiText demo disc + manual + template: lets you do everything except save files. Price refund when you buy the real thing. **£3.50**

ArchiText + manual + template. Introductory offer until 31/8/88. ~~£24.90~~ **£19.90**

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HopeSoft (AB), Hope Cottage, Winterbourne, Newbury, Berks, RG16 8BB. 0635 248472. Established 1981.

LIFE

Rick Hughes takes us through the secrets of life, the universe and everything in his program for the Arc

In the Beginning . . .

Shortly after arriving at university in 1970, I was shown an article in *Scientific American* describing a new mathematical game; I was most impressed to find that the game's inventor was one of my college tutors – John Horton Conway. It was known simply as *Life*. Since then *Life* has found a world-wide following and it is estimated to be responsible for wasting more computer time – illicitly – than the record holders 'Start Trek' and 'Adventure' of the time. Note for younger readers – these were like the video games of today (only in the days before most people could afford to have computers sitting on their desktops).

It is easy to see why *Life* has been so popular: it is simple, unpredictable and apparently limitless. It can't be 'solved' like a Rubik's Cube and the 'player' always feels he is capable of making some new discovery. Furthermore Conway, (and others) have shown that *Life* can simulate the behaviour of a huge computer (an ironic twist seeing as we are going to describe the means for computerising the game in the first place) and this has opened new mathematical doors. Many readers will already be familiar with *Life* – though not perhaps with this esoteric aspect of it – but for those who are not we will begin with a brief description.

The Facts of Life

Before going any further I should point out that I did not invent the games' title so I'm not to blame for rotten puns such as the title of this section. The origin of the title is biological – patterns of 'cells' form 'organisms' which can 'live' and 'die' – and do all those other things that organisms get up to. Despite this, the game itself is purely mathematical and bears no relationship to any species of organism (living or dead). In fact *Life* is not a game at all in the usual sense, and it is more closely related to solitaire or card patience in that there is only one 'player' whose moves are determined by the application of fixed rules.

The basic idea is very simple – played out against a background lattice, such as a Chessboard; a pattern of cells is created, by occupying some of the squares with say, counters. This pattern is now subjected to certain 'genetic laws' to see what its next generation will be – this may well create a new shape and the whole process repeats. Thus the pattern 'evolves'. There are only three simple genetic laws, but before we describe them, observe that any cell has exactly 8 neighbouring cells (Fig 1) – this concept of a neighbour is fundamental to the rules.

1. Birth Rule – If an empty cell has EXACTLY three neighbours, it will become occupied on the next generation.

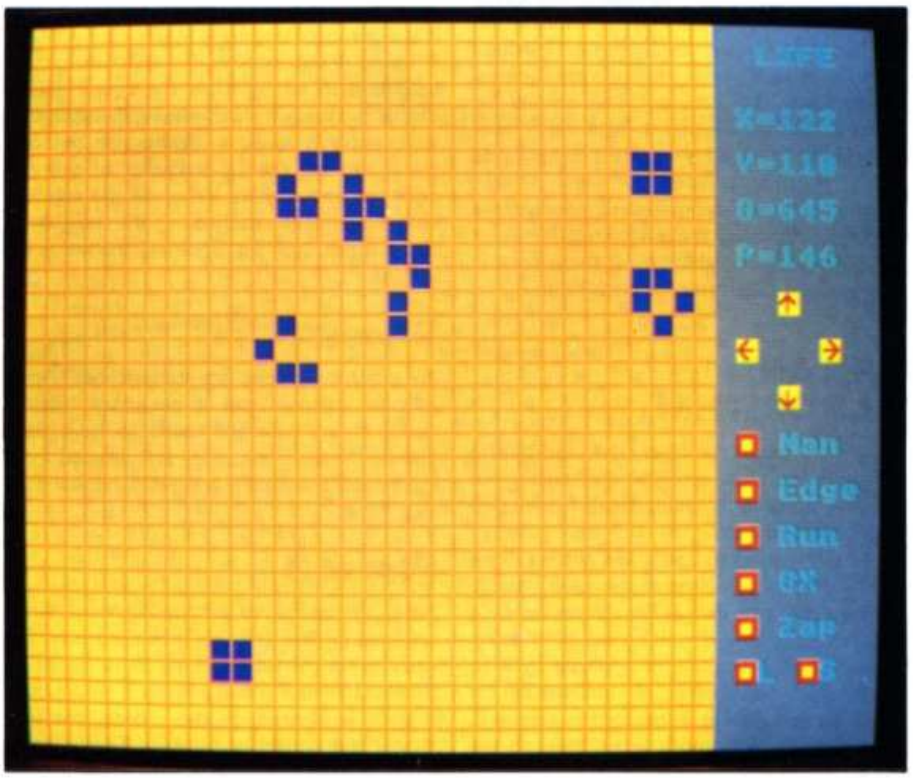
2. Survival Rule – If an occupied cell has exactly 2 or 3 neighbours, it survives to the next generation.

3. Death Rule – If an occupied cell has less than 2, or more than 3 neighbours, it dies – in the first case through starvation and in the second through overcrowding.

Notice that birth and death occur simultaneously and so a cell that is about to die can participate in the birth of another – this is a very moral game. These three simple rules provide an astonishing range of behaviour and many remarkable discoveries have been made. Despite their simplicity they were only arrived at by a laborious process of trial-and-error and are the only rules which provide such a rich structure. To illustrate these rules in action we consider the fates of three life forms – see if you can follow these for yourself:

Fig 2 shows an example of an OSCILLATOR – this one is called a 'blinker'. If no other cells interfere with it, it will continue to blink forever. Many other oscillators are known, some with quite long periodic cycles. Fig 3 shows a common STABLE shape (the 'Bee-hive'). Many large life forms produce these at some stage of their development. Fig 4 shows a more obstinate pattern – we have run out of paper for it but we shall mention it again later – it is known as the 'R-Pentomino'. It is patterns such as this one that prompted Conway – and everyone after him – to abandon counters and squared paper and turn to computers for the answers to harder *Life* questions.

The rest of the article describes a new version of the *Life* program for the Archimedes computer and, as you would expect from such a powerful machine, the program



runs very quickly. This adds greatly to the study of *Life* patterns as they seem to swim and flow and behave like living organisms as seen under a microscope. Also, we use a lattice of 256 x 256 cells, which is sufficient to display All but the largest of interesting life-forms.

The Secret of Life

From the above description it will be seen that *Life* is an obvious candidate for computerisation, and indeed most computers have a version of it. The simplicity of the rules make it a good programming exercise to illustrate the use of loops, arrays etc. However, most such programs are only treated as an exercise and are impractical for the purposes of making any (real) life investigations. A typical program will use a limited screen size, such as the BBC's 40 x 25 teletext screen and an algorithm similar to the following:

FOR EVERY CELL IN THE ARRAY DO THIS: COUNT THE NEIGHBOURS IF THE CELL IS EMPTY AND NEIGHBOURS=3 FLAG IT AS A BIRTH CELL ELSE IF NEIGHBOURS EQUAL LESS THAN 2 OR NEIGHBOURS GREATER THAN 3 FLAG IT AS A DEATH CELL. FOR EVERY CELL IN THE ARRAY DO THIS: IF IT IS MARKED TO DIE, KILL IT IF IT IS MARKED AS A BIRTH, OCCUPY IT.

This algorithm is very simple to implement as it only involves the use of one array but it does have the disadvantage that all cells, whether or not they are near the scene of any action need to be scanned. In BASIC this can take up to 2 minutes to complete one generation, although assembler programs are actually quite fast. Unfortunately this algorithm is not suitable for a fast 256 x 256 *Life* as that would involve scanning the neighbours of over 65,000 cells. Furthermore, it does not represent a very 'human' approach to the problem – it should be obvious at a glance that a huge array with only 3 cells occupied is no more complicated than a small array with the same 3 cells. Consequently we only need to concentrate on those cells that are alive, together with their immediate neighbours, as these are the only possible candidates for birth cells.

THE ARM ALGORITHM

Before discussing the algorithm used by this program, we must consider the stucture of the data available to it: this data is held in two tables and two lists:–

Atable – contains 256 x 256 entries – one byte for each cell alive at the time. *Atable* contains the same data as the screen, only in a different format – ie it is a map of all living cells. Although the use of a whole byte to store one bits-worth of information is wasteful, we are not interested in elegance, only speed; the memory is available, so we use it.

Btable – also contains 256 x 256 bytes (one for each cell) and holds Birth information for that cell. All empty cells near living ones will have their bytes updated in this table. Any cell that has a neighbour count of exactly 3 will be born on the next generation.

Alist – This is a dynamic list – its size changes as the program progresses.

The information it contains is EXACTLY the same as that held in *Atable* this is again wasteful, but these two-way tables allow very fast access to data. The entries in *Alist* are 4 bytes containing the (x,y) co-ordinates of the cell and two zero bytes. One of these two bytes is set to &FF to indicate the last item in the list and the other is used as a you-are-about-to-die flag. The space allocated to *Alist* is 12000 bytes which will accommodate a population of 3000. *Blist* – This dynamic list contains data in the same format as *Alist* and shows which elements of *Btable* are non-zero. In other words, it contains all potential birth cells.

Theoretically this list should be 8 times the size of *AList* to cover all situations, but in sensible circumstances the limit will never be reached. Before executing the generation code, *Btable and Blist are cleared. Atable* contains an indicator (put there by the editor) for every living cell and *Alist* is filled in by scanning the table ONCE. To execute a generation, three passes are made of the lists as follows:

Phase 1

This is where most of the work is done. *Alist* is read to the end and for each entry found, we look up its 8 neighbours (in *Atable* – this is quick). Ideally, the neighbouring cell is occupied and we just add one to a count and then proceed to the next neighbour. If we are unlucky, the cell is empty; this means that it is a potential birth cell. In this case we look it up in *Btable* to see if it has been found before; if so we augment the count held in *Btable* and carry on with the next neighbour. If no entry is found in *Btable*, we put one there and tag the co-ordinates of this cell onto the end of *Blist*. When all the adjacent cells have been studied, if the neighbour count is not 2 or 3 a 'doomed' marker is set in *Alist*.

Phase 2

All death-sentences are carried out. Again *Alist* is scanned, and if necessary, packed down. If any cells are found to have their doomed marker set, they are deleted from the screen and *Atable* and NOT copied back into *Alist*.

Phase 3

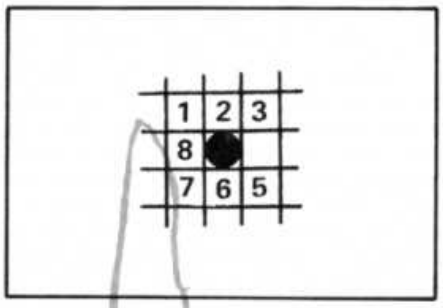
Now we attend to births. Potential births are held in *Blist* and this is read serially. For each cell in the list, we look up its count (in *Btable)* to see if it had exactly 3 neighbours. If so it is plotted on the screen, put into *Atable* and tagged on to *Alist*. Finally, it has to be deleted fron *Btable*. This phase finishes when we reach the end of the list, at which point the list is abandoned (by moving &FFFFFFFF to the first entry), and the generation is complete. By now, the data is in exactly the state it was when we started Phase 1 and so we can start again at Phase 1 for the next generation. To implement this algorithm in the shortest possible time, the routine is written in ARM assembly code – the rest of the program is written in BASIC.

PROGRAM FEATURES

Life is best in real-time and to achieve the necessary speed it needs to run in machine-code. The other aspects of the program – user interface, file handling etc. are not so critical and they are written in BASIC. The program was written on an Archimedes 310 fitted with Arthur (OS) 1.2 and runs entirely in Mode 9. Although the code only occupies about 16K, the data tables described above consume another 233K. However, it is these tables that enable the great speed of the program to be realised, rather than the fact that the generation code is written in ARM assembler (as opposed to any other assembly language).

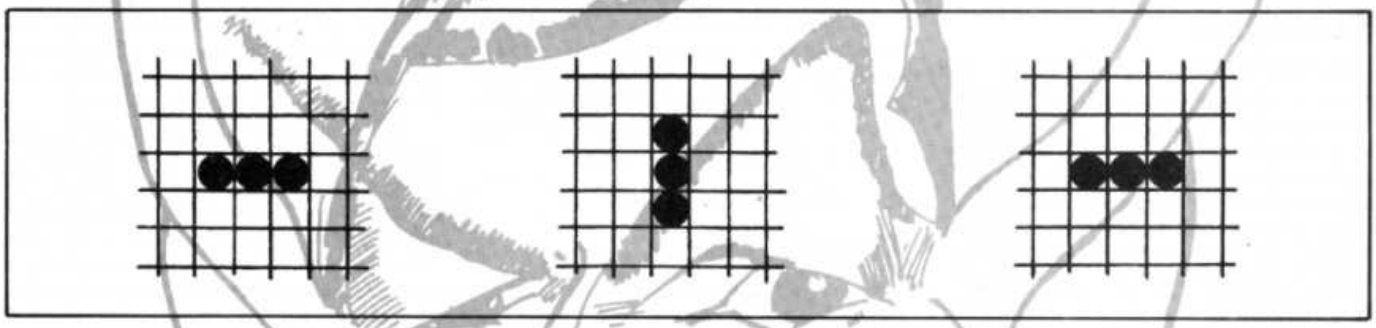
To bench-mark the program through its various stages of development I used the R-pentomino and followed through its 1103 generations until it stabilised. In 1X magnification, this took 27 seconds using an earlier version of the program to the one given here. In this version the cells were plotted as dots on the screen using 'OS–Plot' and as an experiment I deleted the call to this OS routine to see how the timing was affected – this resulted in a reduction of 13 seconds – half the time was being spent plotting (and deleting) cells! Consequently, the version given writes directly to screen RAM when plotting in 1X mode to achieve a bench-mark of approximately 15 seconds – an average of 73 generations per second. Of course the speed is dependent upon the amount of work done ie the population at any time: in this respect it differs greatly from the 'naive' algorithm decribed earlier where there is a fixed task per generation and which runs at a fairly constant (but slow) speed. Even with a population of 500 or so, this program can display 20 generations per second.

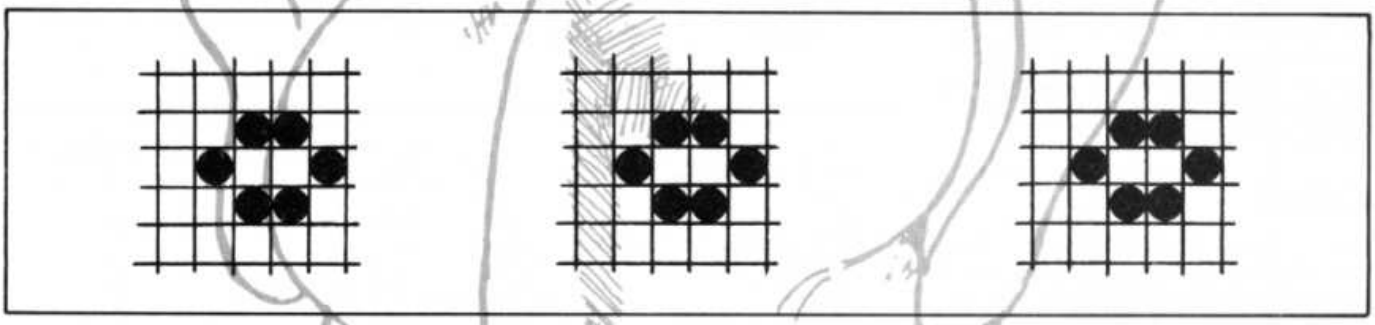
The program is mostly Mouse-Driven and allows you to run, edit, load and save *Life* patterns. The display is in two parts – the graphics area on the left is used to display the current pattern while the text area on the right contains status information; from the top, the significance of each item is: X and Y are the co-ordinates of the bottom left hand corner of the edit box (see '1X/8X' later). G is the number of the present generation – it doesn't get filled in until the pattern has started to run. P is the present population. Clicking any of the mouse buttons on one of the direction icons will cause the display to move in that direction provided you are in editing mode (magnification=8X). They have no effect when magnification=1X. Auto/Man Clicking on this flag toggles between these two modes.

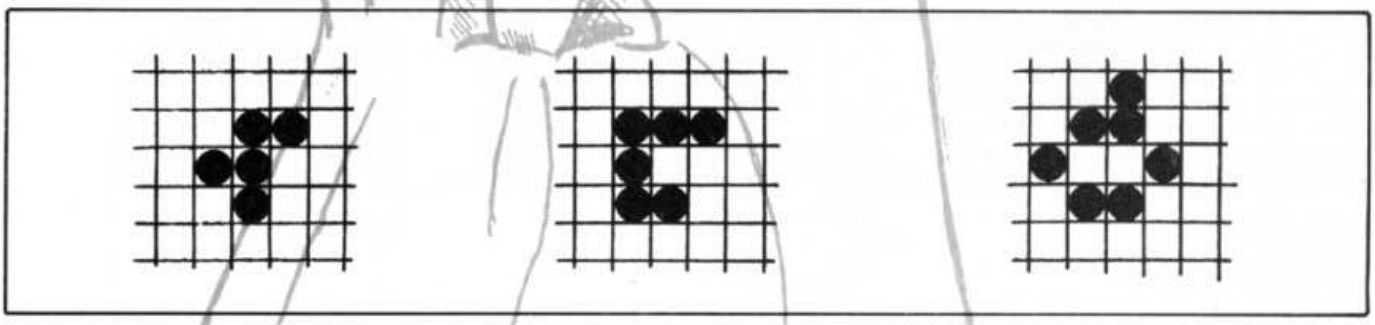


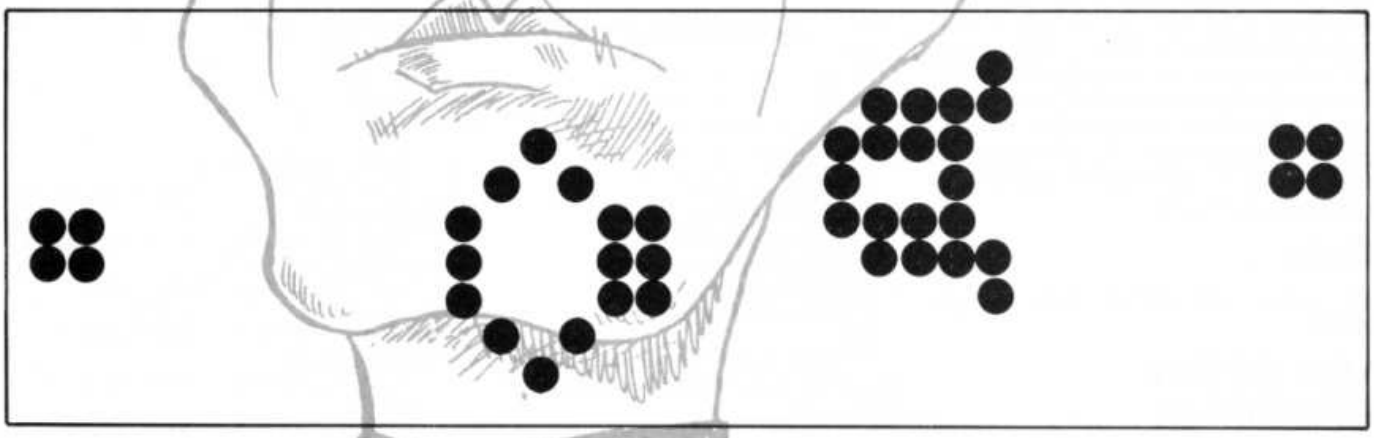
Auto

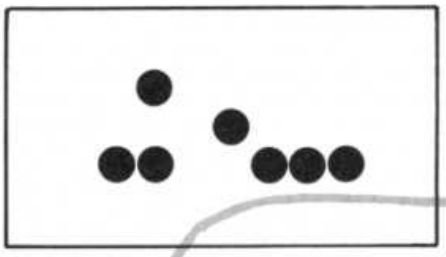
In 'Auto' the generations are executed successively until you press 'ESCAPE', while in 'Man', you have to press the Space-Bar to step to the next generation. This enables you to slowly step through the life-cycle of the pattern. Edge/Wrap Although 256 x 256 seems like a decent sized screen, the rules of *Life* require that an infinite array is used. Some patterns throw off shapes that whizz off the edge of the screen and we want them to disappear as soon as they hit the edge – this is 'Edge' mode. However we may be tracking a shape near the edge of the screen that just overflows the edge. If 'Edge' is set, then the pattern will be corrupted; however if we toggle to 'Wrap' before the shape reaches the edge, it will wrap around the edge of the screen and come back on the other side, progressing normally – provided it doesn't interact with itself (can be fun!) then the final result will be correct, if we take screen wrap into consideration.











Stop/Run

Clicking to 'Run' causes the pattern to start living, at whatever size magnification is set. 'Stop' is actually two modes:

- (i) When magnification = 1X, moving the mouse into the display area and clicking a button causes the edit square to be displayed – you can drag this round to your heart's content. Returning to magnification = 8X causes that area to be magnified for editing.
- (ii) When magnification = 8X, moving the mouse into the (gridded) display area allows you to toggle cells on and off by clicking a mouse button – this is the means by which you enter patterns. Once your structure starts to live, you can stop it at any time by pressing 'ESCAPE', which brings the pointer back to the screen.

1X/8X

This is the magnification factor: 1X shows each cell as a single dot, thus allowing the full screen of 256 x 256 cells to be displayed; this is the mode you will probably choose to watch your patterns grow. 8X gives a 32 x 32 window which can be moved around over the whole array – choose this mode to edit you pattern or monitor the progress of a small section of it. Kill Clicking on the Kill option (which requires confirmation) will delete the existing pattern and reset the generation and population counts back to 0.

L and S

These save patterns to, or load them from, disc. Shapes are stored in the directory '$.Life–Forms' – obviously this needs to exist on your disc before you can save anything to it. To load a file, click the mouse to its highlighted initial letter – note that this will overwrite any shape already in memory, so be careful. If you decide NOT to load a file after all, click on the 'Abandon Load' box and no harm has been done. To save a pattern, simply type its 10-character (maximum) name when prompted.

Quit

Will (after confirmation) return you to BASIC.

USE OF THE PROGRAM

Having typed in the program you should save it to disc before attempting to run it. While this is always advisable, it is essential for any program that contains assembly code or cancels the effect of the ESCAPE key. Once the program has started, use the mouse to enter the R-pentomino pattern shown in Fig 4 – clicking 'Stop' will toggle it to 'Run' and start the pattern off. Now press ESCAPE (it is only active during 'Run') and click on '8X'; this should toggle to '1X' and display the whole of the pattern on the full 256 x 256 grid.

Experiment with 'Auto', 'Wrap' etc. to check that they work as described above. You should find after a short time that the program is very easy to use and you will soon be looking for interesting life forms to add to your collection – don't forget to save them BEFORE you run them! To prepare a disc for use with the program, simply *MOUNT the disc, and then *CDIR Life–Forms.

That's Life

LIFE is a fascinating, almost hypnotic pastime and there are doubtless many weird and wonderful patterns waiting to be discovered – plenty of computing power all over the world has already been expended in the quest. Many of these have colourful, yet appropriate names, this being a trend started by Conway who is a witty and highly creative person. As you experiment with the program you will almost certainly discover 'gliders' (they fly), 'traffic lights' (they oscillate), 'blocks' and 'boats' (they don't do anything) and perhaps find some new creation formed by crashing several gliders into each other. Unfortunately there is not space to list too many patterns but to get you started, we end with a couple of interesting life forms – others can be found in back issues of computer journals or books such as 'Wheels, Life, and other Mathematical Amusements' by Martin Gardner and 'Winning Ways' co-written by the great Conway himself.

The first pattern (Fig 5) is the famous 'glider-gun' discovered at M.I.T. in America and is an example of a pattern that grows forever – you will see how when you have run it. The second pattern (Fig 6) is called 'The Acorn', and it was *NOT* sponsored by a famous computer company. This is a so-called 'Methuselah' pattern – no wonder, those 7 cells evolve for 5206 generations!!

May you have a long and successful *LIFE!*

```
   10REM >Life
   20REM (C) Rick Hughes
21/1/88
   30
   40ON ERROR GOTO 8480
   50*KEY1 EDIT M
   60MODE 9
   70OFF
   80@%=0
   90
  100DIM Cell%(7,31),Code
1000,InBlock 8,OutBlock 8
  110DIM Atable 256*256,Btable
256*256,Alist 12000,Blist
90000
  120DIM Name 16,Dir_Name
16,Files$(60),Star 1
  130
  140IF Atable AND 3 THEN
STOP
  150
  160$Star="*"

170Directory$="$.Life_Forms"

180$Dir_Name=Directory$+CHR$0
  190
  200PROCsetcols
  210PROCassemble
  220PROCmouseblobs
  230PROCsetup
  240PROCdrawscreen
  250CALL Clear
  260PROCshowcoords
  270PROCshowauto
  280PROCshowwrap
  290PROCshowrun
  300PROCshowmag
  310
  320REM Read screen start
address and compute addr of
last row

330!InBlock=148:InBlock!4=-1
  340SYS
"OS_ReadVduVariables",InBlock,
OutBlock

350!ScreenEnd=!OutBlock+255*32
0/2
  360
  370*FX 229 1
  380
  390REPEAT
  400 *POINTER 1
  410 MOUSE ON
  420 MOUSE RECTANGLE
0,0,1279,1023
  430 REPEAT
  440  MOUSE X%,Y%,Z%
  450  IF Z% PROCclick
  460 UNTIL run OR quit
  470 MOUSE OFF
  480 IF run THEN
  490    *FX 229 0
  500    CALL Doagen
  510    *FX 229 1
  520    PROCshowrun
  530 ENDIF
  540UNTIL quit
  550VDU 20,26
  560CLS
  570ON
  580END
  590
  600
  610DEFPROCsetcols
  620 cgbak%=0 : REM Graphics
background
  630 cgfor%=1 : REM Graphics
foreground
  640 ctbak%=2 : REM Text
background
  650 ctfor%=3 : REM Text
foreground
  660 cgrid%=4 : REM Grid
colour
  670 cblob%=5 : REM Mouse
blobs
  680 cbblb%=6 : REM Mouse
```

```
blob middle
  690 cbox% =7 : REM Box
  700
  710 COLOUR
cgbak%,224,176,80
  720 COLOUR cgfor%,0,0,240
  730 COLOUR
ctbak%,128,128,128
  740 COLOUR ctfor%,0,240,176
  750 COLOUR cgrid%,240,144,0
  760 COLOUR cblob%,240,64,64
  770 COLOUR cbblb%,240,240,0
  780 COLOUR cbox%,192,32,160
  790ENDPROC
  800
  810DEFPROCmouseblobs
  820 REM Positions of mouse
blobs
  830 Cell%(3,12)=253
  840 Cell%(1,14)=251
  850 Cell%(5,14)=252
  860 Cell%(3,16)=254
  870 Cell%(1,18)=1
  880 Cell%(1,20)=2
  890 Cell%(1,22)=3
  900 Cell%(1,24)=4
  910 Cell%(1,26)=5
  920 Cell%(1,28)=6
  930 Cell%(4,28)=7
  940 Cell%(1,30)=8
  950ENDPROC
  960
  970DEFPROCdrawscreen
  980 VDU 28,32,31,39,0
  990 VDU 24,0;0;1023;1023;
 1000 GCOL 0,cgfor%
 1010 GCOL 0,cgbak%+128
 1020 COLOUR ctfor%
 1030 COLOUR ctbak%+128
 1040 CLG
 1050 CLS
 1060 PRINT TAB(2,1)"LIFE"
 1070 PRINT TAB(1, 4)"X="
 1080 PRINT TAB(1, 6)"Y="
 1090 PRINT TAB(1, 8)"G="
 1100 PRINT TAB(1,10)"P=";
 1110 PRINT TAB(3,26)"Kill"
 1120 PRINT TAB(2,28)"L"
 1130 PRINT TAB(5,28)"S"
 1140 PRINT TAB(3,30)"Quit"
 1150
 1160 REM Display all mouse
blobs
 1170 COLOUR cblob%
 1180 COLOUR cbblb%+128
 1190 FOR x%=0 TO 7
 1200  FOR y%=0 TO 31
 1210   Type%=Cell%(x%,y%)
 1220   IF Type%>0 THEN
 1230    PRINT TAB(x%,y%);
 1240    IF Type%<100 THEN
Type%=255
 1250    PRINT CHR$Type%
 1260   ENDIF
 1270 NEXT,
 1280 COLOUR ctfor%
 1290 COLOUR ctbak%+128
 1300ENDPROC
 1310
 1320DEFPROCsetup
 1330 mag=0
 1340 auto=FALSE
 1350 wrap=TRUE
 1360 run=TRUE
 1370 quit=FALSE
 1380 baseX%=120:baseY%=120
 1390
 1400 VDU
23,251,24,48,96,254,96,48,24,0
 1410 VDU
23,252,24,12,6,127,6,12,24,0
 1420 VDU
23,253,16,56,124,214,16,16,16,
0
 1430 VDU
23,254,0,16,16,16,214,124,56,1
6
 1440 VDU
23,255,255,255,195,195,195,195
,255,255
 1450ENDPROC
 1460
 1470DEFPROCclg
 1480CLG
 1490IF mag=1 THEN
 1500 GCOL 0,cgrid%
 1510 FOR I%=32 TO 992 STEP
32
 1520  MOVE I%,0 : DRAW
I%,1023
 1530  MOVE 0,I% : DRAW
1023,I%
 1540 NEXT
 1550ENDIF
 1560CALL Plotlist
 1570ENDPROC
 1580
 1590DEFPROCclick
 1600 IF X%>1023 THEN
 1610    PROCoptions
 1620 ELSE IF mag=1 PROCtoggle
ELSE PROCbox
 1630 ENDIF
 1640 IF Type%<100
REPEAT:MOUSE X%,Y%,Z%:UNTIL
Z%=0
 1650ENDPROC
 1660
 1670DEFPROCoptions
 1680 x%=(X% DIV 32)-32
 1690 y%=31-(Y% DIV 32)
 1700 Type%=Cell%(x%,y%)
 1710 CASE Type% OF
 1720  WHEN   1:PROCshowauto
 1730  WHEN   2:PROCshowwrap
 1740  WHEN   3:PROCshowrun
 1750  WHEN   4:PROCshowmag
 1760  WHEN   5:PROCshowzap
 1770  WHEN   6:PROCload
 1780  WHEN   7:PROCsave
 1790  WHEN   8:PROCshowquit
 1800  WHEN 251:IF mag=1
PROCleft
 1810  WHEN 252:IF mag=1
PROCright
 1820  WHEN 253:IF mag=1
PROCup
 1830  WHEN 254:IF mag=1
PROCdown
 1840 ENDCASE
 1850ENDPROC
 1860
 1870DEFPROCtoggle
 1880 Type%=0
 1890 X%=X% AND &3E0:Y%=Y% AND
&3E0
 1900 x%=baseX%+(X% DIV 32)
 1910 y%=baseY%+(Y% DIV 32)
 1920 full=Atable?(x%+256*y%)
 1930 IF full GCOL 0,cgbak%
ELSE GCOL 0,cgfor%
 1940
Atable?(x%+256*y%)=-(full=0)
 1950 RECTANGLE FILL
X%+4,Y%+4,24,24
 1960ENDPROC
 1970
 1980DEFPROCbox
 1990 x%=4*baseX%:y%=4*baseY%
 2000 GCOL 3,cbox%
 2010 RECTANGLE x%,y%,128
 2020 MOUSE RECTANGLE
0,0,1279,1023-128
 2030 MOUSE TO x%,y%
 2040 REPEAT
 2050  MOUSE X%,Y%,Z%
 2060  IF Z% AND (X%<1023-128)
AND (X%<>x% OR Y%<>y%) THEN
 2070     RECTANGLE x%,y%,128
 2080     RECTANGLE X%,Y%,128
 2090     x%=X%:y%=Y%
 2100     baseX%=X% DIV
4:baseY%=Y% DIV 4
 2110     PROCshowcoords
 2120  ENDIF
 2130  IF X%>1023 RECTANGLE
x%,y%,128
 2140 UNTIL X%>1023
 2150 baseX%=x% DIV
4:baseY%=y% DIV 4
 2160 MOUSE RECTANGLE
0,0,1279,1023
 2170ENDPROC
 2180
 2190DEFPROCshowauto
 2200 auto=NOT auto
 2210 PRINT TAB(3,18);
 2220 IF auto PRINT"Auto" ELSE
PRINT"Man "
 2230ENDPROC
 2240
 2250DEFPROCshowwrap
 2260 wrap=NOT wrap
 2270 PRINT TAB(3,20);
 2280 IF wrap PRINT"Wrap" ELSE
PRINT"Edge"
 2290ENDPROC
 2300
 2310DEFPROCshowrun
 2320 run=NOT run
 2330 PRINT TAB(3,22);
 2340 IF run PRINT"Run " ELSE
PRINT"Stop"
 2350 Status?0=mag
 2360 Status?1=auto
 2370 Status?2=wrap
 2380 !baseX=baseX%
 2390 !baseY=baseY%
 2400ENDPROC
 2410
 2420DEFPROCshowmag
 2430 mag=1-mag
 2440 PRINT TAB(3,24);
 2450 PRINT
MID$("1X8X",1+mag*2,2)
 2460 Status?0=mag
 2470 !baseX=baseX%
 2480 !baseY=baseY%
 2490 CALL Buildlist
 2500 PROCclg
 2510ENDPROC
 2520
 2530DEFPROCshowzap
 2540
zap=FNAreYouSure("Kill")
 2550 IF zap THEN
 2560    CALL Clear
 2570    !Alist=-1
 2580    PRINT TAB(3,8)"0   "
 2590    PRINT TAB(3,10)"0
"
 2600 ENDIF
 2610 PROCclg
 2620ENDPROC
 2630
 2640DEFPROCshowquit
 2650
quit=FNAreYouSure("Quit")
```

```
 2660 IF NOT quit CALL
Buildlist:PROCclg
 2670ENDPROC
 2680
 2690DEFFNAreYouSure(Z$)
 2700 PROCoverlay
 2710 PRINT TAB(1,1)Z$;" - Are
you sure?"
 2720 PRINT TAB(5,3)"Press Y
or N"
 2730 *FX 15
 2740 REPEAT
 2750
G$=GET$:Anser=INSTR("YyNn",G$)
 2760 UNTIL Anser
 2770 MOUSE ON
 2780 MOUSE RECTANGLE
0,0,1279,1023
 2790 VDU 28,32,31,39,0
 2800 COLOUR ctfor%
 2810 COLOUR ctbak%+128
 2820=(Anser<3)
 2830
 2840DEFPROCload
 2850 MOUSE OFF
 2860 VDU 28,0,31,31,0
 2870 COLOUR cgfor%
 2880 COLOUR cgbak%+128
 2890 CLS
 2900 GCOL 0,ctbak%:RECTANGLE
0,0,1023,1023
 2910 xtab%=0:ytab%=0
 2920 Offset%=0
 2930 NumFiles=0
 2940 load=0
 2950
 2960 LOCAL ERROR
 2970 ON ERROR LOCAL
PROCnodir:GOTO 3500
 2980 REPEAT
 2990  SYS
"OS_GBPB",9,Dir_Name,Name,1,Of
fset%,16,Star TO
A%,A%,A%,A%,Offset%
 3000  IF A%=0 GOTO 3120
 3010  NumFiles+=1
 3020  ptr=Name:WHILE
?ptr:ptr+=1:ENDWHILE:?ptr=13
 3030
 3040  COLOUR cbblb%:COLOUR
cblob%+128
 3050  PRINT
TAB(1+10*xtab%,1+ytab%);CHR$(?
Name);
 3060  COLOUR cgfor%:COLOUR
cgbak%+128
 3070  PRINT $(Name+1)
 3080
 3090  Files$(NumFiles)=$Name
 3100  xtab%+=1
 3110  IF xtab%>2
xtab%=0:ytab%+=1
 3120 UNTIL A%=0
 3130 IF NumFiles=0
PROCnofiles:GOTO 3500
 3140
 3150 COLOUR ctbak%:COLOUR
ctfor%+128
 3160 PRINT
TAB(1,30)SPC(9)"Abandon
Load"SPC(9);
 3170
 3180 RESTORE ERROR
 3190 MOUSE ON
 3200 MOUSE RECTANGLE
0,0,1023,1023
 3210 abandon=FALSE
 3220 REPEAT
 3230  MOUSE X%,Y%,Z%
 3240  IF Z% THEN
 3250    x%=X% DIV 32 -1
 3260    xtab%=x% DIV
10:goodx=(x% MOD 10=0)
 3270    y%=31-(Y% DIV 32)
 3280    ytab%=y% :
goody=(y%>0)
 3290    File=xtab%+3*ytab%-2
 3300    IF goodx AND goody
AND File<=NumFiles THEN
load=File
 3310    IF y%=30 THEN
abandon=TRUE
 3320  ENDIF
 3330 UNTIL load OR abandon
 3340
 3350 IF abandon GOTO 3510
 3360
 3370 file$=Files$(File)
 3380 load=FALSE
 3390 PRINT TAB(1,30)" Loading
";file$;SPC(9);
 3400 LOCAL ERROR
 3410 ON ERROR LOCAL
PROCnoload:GOTO 3500
 3420
file%=OPENIN(Directory$+"."+fi
le$)
 3430 WHILE NOT EOF #file%
 3440  INPUT #file%,cell%
 3450  IF NOT load CALL
Clear:load=TRUE
 3460  Atable?cell%=1
 3470 ENDWHILE
 3480 CLOSE #file%
 3490
 3500 RESTORE ERROR
 3510 VDU 28,32,31,39,0
 3520 COLOUR ctfor%
 3530 COLOUR ctbak%+128
 3540 IF load THEN
 3550    PRINT TAB(3,8)"0   "
 3560    PRINT TAB(3,10)"0
"
 3570 ENDIF
 3580 MOUSE ON
 3590 MOUSE RECTANGLE
0,0,1279,1023
 3600 CALL Buildlist
 3610 PROCclg
 3620ENDPROC
 3630
 3640DEFPROCsave
 3650 PROCoverlay
 3660 ON
 3670 PRINT TAB(1,2)"Save
as:";
 3680 SYS
"OS_ReadLine",Name,10,32,126
 3690 file$=$Name
 3700
 3710 LOCAL ERROR
 3720 ON ERROR LOCAL
PROCnosave:GOTO 3830
 3730
file%=OPENOUT(Directory$+"."+f
ile$)
 3740 CALL Buildlist
 3750 ptr=Alist
 3760 WHILE ptr?3 <> 255
 3770  cell%=!ptr
 3780  PRINT #file%,cell%
 3790  ptr+=4
 3800 ENDWHILE
 3810 CLOSE #file%
 3820
 3830 RESTORE ERROR
 3840 VDU 28,32,31,39,0
 3850 COLOUR ctfor%
 3860 COLOUR ctbak%+128
 3870 MOUSE ON
 3880 IF mag=1 CALL Buildlist
 3890 PROCclg
 3900 OFF
 3910ENDPROC
 3920
 3930DEFPROCoverlay
 3940 MOUSE OFF
 3950 VDU 28,5,19,26,15
 3960 COLOUR ctbak%
 3970 COLOUR ctfor%+128
 3980 CLS
 3990 GCOL 0,ctbak%
 4000 RECTANGLE
156,380,708,164
 4010ENDPROC
 4020
 4030DEFPROCnodir
 4040 PRINT TAB(7,14)"Missing
directory!"
 4050 PROCspace(7,16)
 4060ENDPROC
 4070
 4080DEFPROCnosave
 4090 CLS
 4100 PRINT TAB(3,1)"Can't
save file"
 4110 PROCspace(2,3)
 4120ENDPROC
 4130
 4140DEFPROCnofiles
 4150 PRINT TAB(8,14)"No files
found!"
 4160 PROCspace(7,16)
 4170ENDPROC
 4180
 4190DEFPROCnoload
 4200 CLS
 4210 PRINT TAB(8,14)"Can't
load file!"
 4220 PROCspace(7,16)
 4230 abandon=TRUE
 4240ENDPROC
 4250
 4260DEFPROCspace(x%,y%)
 4270 PRINT TAB(x%,y%)"SPACE
to continue"
 4280 *FX 15
 4290 REPEAT UNTIL GET=32
 4300ENDPROC
 4310
 4320DEFPROCleft
 4330 IF baseX%=0 ENDPROC
 4340 PROCscroll(0)
 4350 MOVE 32,0:DRAW 32,1023
 4360 FOR I%=32 TO 992 STEP
32
 4370  MOVE 0,I%:DRAW 32,I%
 4380 NEXT
 4390 baseX%-=1
 4400
 4410 GCOL 0,cgfor%
 4420 x%=baseX%
 4430 FOR I%=0 TO 31
 4440  y%=baseY%+I%
 4450
full=Atable?(x%+256*y%)
 4460  IF full RECTANGLE FILL
4,32*I%+4,24,24
 4470 NEXT
 4480 PROCshowcoords
 4490ENDPROC
 4500
 4510DEFPROCright
 4520 IF baseX%>222 ENDPROC
 4530 PROCscroll(1)
 4540 MOVE 992,0:DRAW
992,1023
 4550 FOR I%=32 TO 992 STEP
```

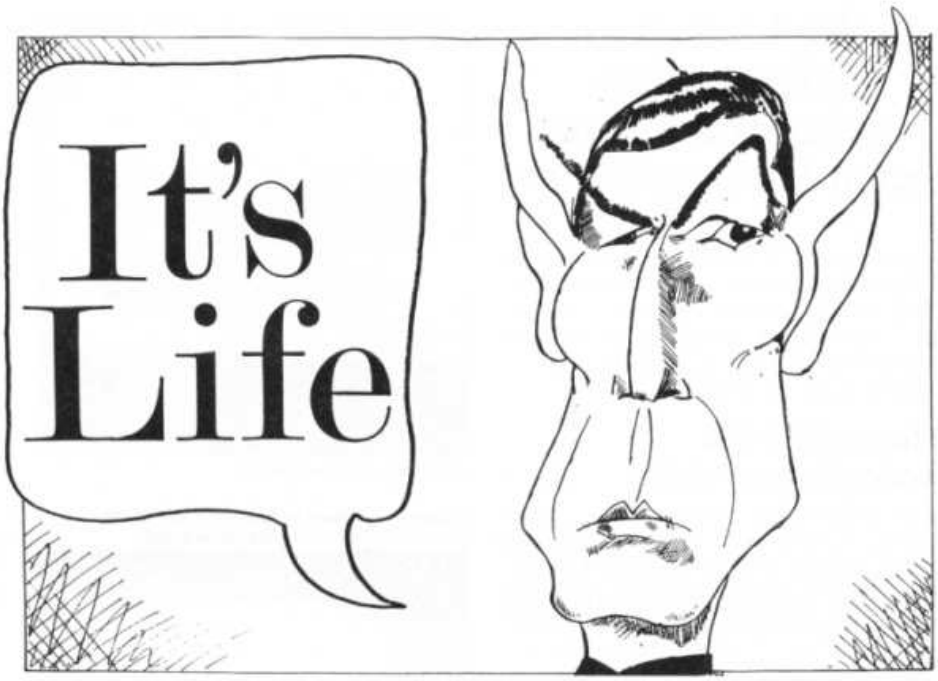
```
32
 4560  MOVE 992,I%:DRAW
1023,I%
 4570 NEXT
 4580 baseX%+=1
 4590
 4600 GCOL 0,cgfor%
 4610 x%=baseX%+31
 4620 FOR I%=0 TO 31
 4630  y%=baseY%+I%
 4640
full=Atable?(x%+256*y%)
 4650  IF full RECTANGLE FILL
996,32*I%+4,24,24
 4660 NEXT
 4670 PROCshowcoords
 4680ENDPROC
 4690
 4700DEFPROCup
 4710 IF baseY%>222 ENDPROC
 4720 PROCscroll(2)
 4730 MOVE 0,992:DRAW
1023,992
 4740 FOR I%=32 TO 992 STEP
32
 4750  MOVE I%,992:DRAW
I%,1023
 4760 NEXT
 4770 baseY%+=1
 4780
 4790 GCOL 0,cgfor%
 4800 y%=baseY%+31
 4810 FOR I%=0 TO 31
 4820  x%=baseX%+I%
 4830
full=Atable?(x%+256*y%)
 4840  IF full RECTANGLE FILL
32*I%+4,996,24,24
 4850 NEXT
 4860 PROCshowcoords
 4870ENDPROC
 4880
 4890DEFPROCdown
 4900 IF baseY%=0 ENDPROC
 4910 PROCscroll(3)
 4920 MOVE 0,32:DRAW 1023,32
 4930 FOR I%=32 TO 992 STEP
32
 4940  MOVE I%,0:DRAW I%,32
 4950 NEXT
 4960 baseY%-=1
 4970
 4980 GCOL 0,cgfor%
 4990 y%=baseY%
 5000 FOR I%=0 TO 31
 5010  x%=baseX%+I%
 5020
full=Atable?(x%+256*y%)
 5030  IF full RECTANGLE FILL
32*I%+4,4,24,24
 5040 NEXT
 5050 PROCshowcoords
 5060ENDPROC
 5070
 5080DEFPROCscroll(S%)
 5090 COLOUR cgbak%+128
 5100 VDU 28,0,31,31,0
 5110 VDU 23,7,0,S%,0,
0,0,0,0,0
 5120 VDU 28,32,31,39,0
 5130 COLOUR ctbak%+128
 5140 GCOL cgrid%
 5150ENDPROC
 5160
 5170DEFPROCshowcoords
 5180 PRINT TAB(3,4)baseX%;"
"
 5190 PRINT TAB(3,6)baseY%;"
"
 5200ENDPROC
 5210
 5220DEFPROCassemble
 5230FOR pass%=0 TO 2 STEP 2
 5240P%=Code
 5250[OPT pass%:
 5260; Register usage:
 5270; R0 - R5 General work
 5280; R6   ABtable
 5290; R7   AAtable
 5300; R8   ABlist
 5310; R9   AAlist
 5320; R12  Status word
(bytes- 0/wrap/auto/mag)
 5330; R13  BASIC stack
 5340; R14  Link (return to
BASIC)
 5350
 5360ALIGN
 5370.ABtable     EQUD Btable
 5380.AAtable     EQUD Atable
 5390.ABlist      EQUD Blist
 5400.AAlist      EQUD Alist
 5410.ScreenEnd   EQUD 0
 5420.baseX       EQUD 0
 5430.baseY       EQUD 0
 5440.Gen         EQUD 0
 5450.Pop         EQUD 0
 5460.Status      EQUD 0
 5470.Disptable   EQUD 255:EQUD
255 ; (-1,-1)
 5480             EQUD 255:EQUD
 0 ; (-1, 0)
 5490             EQUD 255:EQUD
 1 ; (-1, 1)
 5500             EQUD   0:EQUD
255 ; ( 0,-1)
 5510             EQUD   0:EQUD
 1 ; ( 0, 1)
 5520             EQUD   1:EQUD
255 ; ( 1,-1)
 5530             EQUD   1:EQUD
 0 ; ( 1, 0)
 5540             EQUD   1:EQUD
 1 ; ( 1, 1)
 5550.Buffer      EQUD 0
 5560.Gcol00      EQUB 18:EQUB
0:EQUB cgbak%
 5570             EQUB 0
 5580.Gcol01      EQUB 18:EQUB
0:EQUB cgfor%
 5590
 5600 ALIGN
 5610;Initialise Atable and
Btable
 5620.Clear
 5630 MOV    R4,#256*256
 5640 MOV    R5,#0
 5650 STR    R5,Gen
;Generation=0
 5660 STR    R5,Pop
;Population=0
 5670 LDR    R6,ABtable
 5680 LDR    R7,AAtable
 5690
 5700.Loop
 5710 STR    R5,[R6],#4
 5720 STR    R5,[R7],#4
 5730 SUBS   R4,R4,#4
 5740 BNE    Loop
 5750 MOV    PC,R14
 5760:
 5770;Build 'Alist' from
'Atable' and compute
population
 5780.Buildlist
 5790 LDR    R9,AAlist
;Pointer to list
 5800 MOV    R5,#0
;R5 scans the table
 5810 MOV    R2,#0
;R2=population
 5820 LDR    R7,AAtable
 5830
 5840.Buildloop
 5850 LDRB   R0,[R7,R5]
 5860 TST    R0,#&FF
 5870 BEQ    Notthere
 5880 STR    R5,[R9],#4
 5890 ADD    R2,R2,#1
 5900
 5910.Notthere
 5920 ADD    R5,R5,#1
 5930 TST    R5,#&10000
;>256*256?
 5940 BEQ    Buildloop
 5950 MVN    R0,#0
 5960 STR    R0,[R9]
 5970 STR    R2,Pop
 5980 MOV    PC,R14
 5990 :
 6000;Plot the contents of
'Alist' and compute 'Pop'
 6010.Plotlist
 6020 STMFD  R13!,{R14}
 6030 LDR    R9,AAlist
;Pointer to list
 6040 LDR    R12,Status
 6050 TST    R12,#3
;full magnification?
 6060 BEQ    Plotloop
;no - don't bother with gcol
 6070 ADR    R0,Gcol01
;Go blue!
 6080 MOV    R1,#3
 6090 SWI    "OS_WriteN"
 6100
 6110.Plotloop
 6120 LDR    R0,[R9],#4
 6130 TST    R0,#&FF000000
 6140 BNE    Finito
 6150 BL     Popup
 6160 B      Plotloop
 6170:
 6180:
 6190;********** Phase1
***********
 6200.Doagen
 6210 STMFD  R13!,{R14}
 6220 BL     Buildlist
 6230 LDR    R12,Status
 6240
 6250;Augment and display the
generation
 6260.Reentry
 6270 LDR    R0,Gen
 6280 ADD    R0,R0,#1
 6290 STR    R0,Gen
 6300 ADR    R1,Buffer
 6310 MOV    R2,#4
 6320 SWI
"OS_BinaryToDecimal"
 6330 SWI    "OS_WriteS"
 6340 EQUB 31:EQUB 3:EQUB
8:EQUB 0
 6350 ADR    R0,Buffer
 6360 MOV    R1,R2
 6370 SWI    "OS_WriteN"
 6380
 6390;Display the population
 6400 LDR    R0,Pop
 6410 ADR    R1,Buffer
 6420 MOV    R2,#4
 6430 SWI
"OS_BinaryToDecimal"
 6440 SWI    "OS_WriteS"
 6450 EQUB 31:EQUB 3:EQUB
10:EQUB 0
 6460 ADR    R0,Buffer
 6470 MOV    R1,R2
 6480 SWI    "OS_WriteN"
```

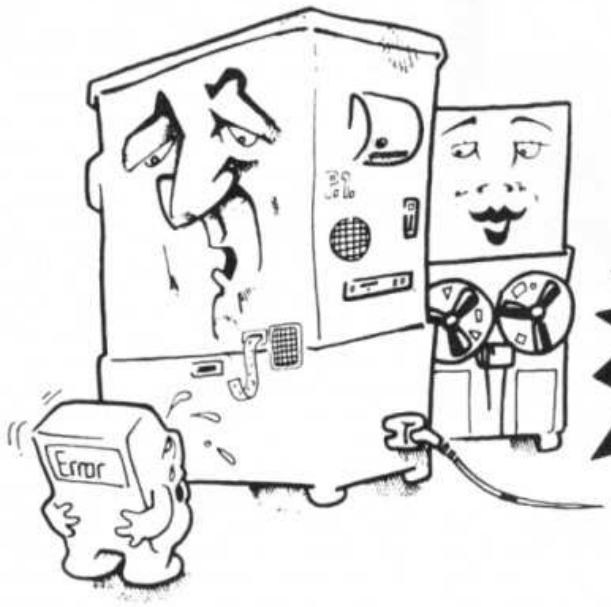
```
 6490 SWI    &100+ASC" "
 6500
 6510 TST    R12,#&FF00
;In Auto mode?
 6520 BNE    DontWait
;No - go
 6530.Spacecheck
 6540 SWI    "OS_Readc"
;wait for <SPACE>
 6550 BCS    Escaped
 6560 CMP    R0,#ASC" "
 6570 BNE    Spacecheck
 6580
 6590;Generation code
proper..Phase1
 6600.DontWait
 6610 LDR    R6,ABtable
 6620 LDR    R7,AAtable
 6630 LDR    R8,ABlist
 6640 LDR    R9,AAlist
 6650 MVN    R0,#0
 6660 STR    R0,[R8]
;!Blist=-1
 6670
 6680.P1Loop
 6690 LDR    R0,[R9],#4
;Read Alist
 6700 TST    R0,#&F0000000
;End of list?
 6710 BNE    P1Endloop
;Yes - go
 6720 MOV    R1,#7
;Do this 8 times..
 6730 MOV    R2,#0
;neighbours=0
 6740 ADR    R3,Disptable
 6750
 6760.Reloop
 6770 MOV    R5,R0
;Want to keep (x,y)
 6780 MOV    R4,R5,LSR #8
;R4=Y
 6790 LDR    R10,[R3],#4
;R10=dx
 6800 ADD    R5,R5,R10
 6810 AND    R5,R5,#&FF
;R5=newx
 6820 LDR    R10,[R3],#4
;R10=dy
 6830 ADD    R4,R4,R10
 6840 AND    R4,R4,#&FF
;R4=newy
 6850 ORR    R5,R5,R4,LSL #8
;R5=newx+256*newy
 6860 LDRB   R10,[R5,R7]
;R10=contents of neighbour
 6870 TST    R10,#&FF
;anything there?
 6880 ADDNE  R2,R2,#1
;neighbours+=1
 6890 BNE    Reread
 6900
 6910 LDRB   R10,[R5,R6]
;R10=no of times born
 6920 ADD    R10,R10,#1
 6930 STRB   R10,[R5,R6]
 6940 CMP    R10,#1
;been born before?
 6950 STREQ  R5,[R8],#4
;no - shove in Blist
 6960
 6970.Reread
 6980 SUBS   R1,R1,#1
;next neighbour
 6990 BPL    Reloop
 7000 EOR    R2,R2,#2
;2 or 3 neighbours?
 7010 CMP    R2,#2
 7020 STRGEB R1,[R9,#-2]
;no - condemn it
 7030 B      P1Loop
 7040:
 7050.P1Endloop
 7060 MVN    R0,#0
 7070 STR    R0,[R8]
;mark end of Birth list
 7080
 7090;********** Phase2 - the
curse of death  **********
 7100 LDR    R9,AAlist
;R9='from"
 7110 MOV    R5,R9
;R5='to'
 7120 TST    R12,#3
;full magnification?
 7130 BEQ    P2Loop
;no - don't bother with gcol
 7140 ADR    R0,Gcol00
 7150 MOV    R1,#3
 7160 SWI    "OS_WriteN"
 7170
 7180.P2Loop
 7190 LDR    R0,[R9],#4
;consider cell
 7200 TST    R0,#&FF000000
;end of list?
 7210 BNE    P2Endloop
;yes - go
 7220 TST    R0,#&FF0000
;condemned?
 7230 BNE    Else
;yes - bye-bye
 7240
 7250 TST    R12,#&FF0000
;wraparound?
 7260 BNE    Wrapper
;yes - it lives
 7270 TST    R0,#&FF
;X=0?
 7280 BEQ    Zapit
;yes - see you
 7290 TST    R0,#&FF00
;Y=0?
 7300 BEQ    Zapit
 7310
 7320.Wrapper
 7330 STR    R0,[R5],#4
;no - keep it in list
 7340 B      P2Loop
 7350:
 7360.Else
 7370 BIC    R0,R0,#&FF0000
 7380
 7390.Zapit
 7400 MOV    R1,#0
 7410 STRB   R1,[R0,R7]
;clear it from Atable..
 7420 BL     Dotplot
;..and from the screen
 7430 LDR    R0,Pop
;RIP. Sic transit etc.etc
 7440 SUB    R0,R0,#1
 7450 STR    R0,Pop
 7460 B      P2Loop
 7470:
 7480.P2Endloop
 7490 MVN    R1,#0
 7500 STR    R1,[R5]
;flag new end of Alist
 7510
 7520;********** Phase3 - the
miracle of birth..
**********
 7530;R5 contains 'to' - ptr
to Alist
 7540 LDR    R8,ABlist
 7550 MOV    R11,#0
 7560 TST    R12,#3
;full magnification?
 7570 BEQ    P3Loop
;no - go
 7580 ADR    R0,Gcol01
 7590 MOV    R1,#3
 7600 SWI    "OS_WriteN"
 7610
 7620.P3Loop
 7630 LDR    R0,[R8],#4
;consider Birth list
 7640 TST    R0,#&FF000000
;at the end?
 7650 BNE    Endloop
;yes - go
 7660 LDRB   R1,[R0,R6]
;how many neighbours?
 7670 STRB   R11,[R0,R6]
;wipe from Btable
 7680 CMP    R1,#3
;if 3 then..
 7690 BLEQ   Occupy
;..it's a boy!
 7700 B      P3Loop
 7710:
 7720.Endloop
 7730 MVN    R0,#0
 7740 STR    R0,[R5]
 7750 SWI
"OS_ReadEscapeState"
 7760 BCC    Reentry
 7770
 7780.Escaped
 7790 MOV    R0,#126
;acknowledge ESCAPE
 7800 SWI    "OS_Byte"
 7810
 7820.Finito
 7830 LDMFD  R13!,{PC}
;Pull return address to BASIC
 7840:
 7850:
 7860;Occupy cell given by
R0=..yx
 7870;On entry,R1<>0 (it's
actually 3)
 7880.Occupy
 7890 STRB   R1,[R0,R7]
 7900 STR    R0,[R5],#4
;copy to Alist
 7910
 7920.Popup
 7930 LDR    R2,Pop
;augment the population
 7940 ADD    R2,R2,#1
 7950 STR    R2,Pop
 7960.Dotplot
 7970 TST    R12,#3
;full magnification?
 7980 BNE    Squareplot
;yes - go
 7990 LDR    R1,ScreenEnd
 8000 MOV    R2,R0,LSR #1
;X DIV 2
 8010 AND    R2,R2,#&7F
 8020 ADD    R1,R1,R2
;screen_end + X DIV 2
 8030 MOV    R3,R0,LSR #8
 8040 ADD    R3,R3,R3,LSL #2
;Y*5
 8050 SUB    R1,R1,R3,LSL #5
;screen_end + X DIV 2 - Y*160
 8060 MOV    R2,#1
 8070 TST    R0,#1
;left or right nibble?
 8080 MOVNE  R2,#&10
 8090 LDRB   R3,[R1]
;fetch two dots..
 8100 EOR    R3,R3,R2
;..toggle one...
 8110 STRB   R3,[R1]
;...and store it back
 8120 MOV    PC,R14
```

First

ARCHIMEDES LISTING

```
 8130:
 8140;Draw a 'big dot' - ie a
square
 8150.Squareplot
 8160 MOV    R2,R0,LSR #8
;R2=Y
 8170 LDR    R3,baseY
 8180 SUBS   R2,R2,R3
;Fit on this screen?
 8190 BMI    Reject
 8200 CMP    R2,#31
;'31' depends on mag
 8210 BGT    Reject
 8220 AND    R1,R0,#&FF
;R1=X
 8230 LDR    R3,baseX
 8240 SUBS   R1,R1,R3
 8250 BMI    Reject
 8260 CMP    R1,#31
;ditto
 8270 BGT    Reject
 8280
 8290;Am allowed to draw this
on screen
 8300 MOV    R1,R1,LSL #5
;32*X
 8310 ADD    R1,R1,#4
 8320 MOV    R2,R2,LSL #5
;32*Y
 8330 ADD    R2,R2,#4
 8340 MOV    R0,#4
 8350 SWI    "OS_Plot"
;MOVE 32X+4,32Y+4
 8360 MOV    R0,#97
 8370 MOV    R1,#24
 8380 MOV    R2,#24
 8390 SWI    "OS Plot"
;Rectangle fill
 8400
 8410.Reject
 8420 MOV    PC,R14
 8430:
 8440:]
 8450NEXT pass%
 8460ENDPROC
 8470
 8480REM Error handling
 8490ON ERROR OFF
 8500VDU 26
 8510ON
 8520REPORT
 8530PRINT" at ";ERL
 8540END
```





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Jon Vogler

LOW COST LASERS

We look at an alternative selection of low cost laser printers

Last month I discussed three laser printers priced below £2200 in some detail. This month's article discusses a further five and give a comparative table of features along with my own recommendations on which to buy.

Canon LBP-8II Laser Beam Printer

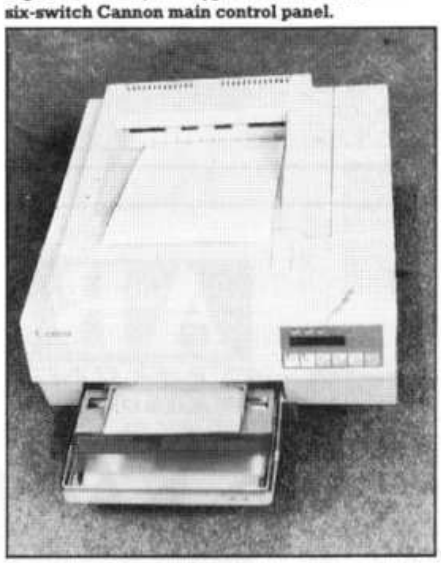
This uses Canon's own *LBP-SX* engine (Fig 1), most famous for its use in the most recent model Hewlett-Packard *LaserJet Plus*. It is, in general, well constructed on a substantial metal chassis although there are some fragile looking plastic lugs and some very skinny metal springs. However it is undoubtedly a much more substantial structure than the Ricoh engine. Moving parts are much smoother, such as the adjustable width envelope guides and the catch for opening the clam shell. The flush, membrane-type switches on the six-switch main control panel (Fig 2) have a pleasant positive click and there is a sixteen character display but you cannot vary its brightness or contrast and it is a little difficult to read unless the light is extremely good. The machine is quiet and the paper feed mechanism makes little more than a purr.

There are two speeds on the cooling fan: for a short period after printing has taken place the fan runs extra fast and rather more noisily but, when the machine has cooled sufficiently, it dies back to a background whisper. Paper handling is excellent: even paper which I had deliberately crumpled up was fed smoothly through and ironed out, although inevitably the print quality suffered. I did not suffer a single paper jam while testing the machine even though I was working, mostly on once-used scrap paper: a striking contrast to the Ricoh machine.

It sits on substantial rubber feet and comes with dual interfaces fitted as well as having space for two font cartridges (although none were provided for my test). Toner and drum come in a single unit, replaceable after 4,000 copies at a cost of £95 which works out at just over two pence per copy (excluding paper and power). The engine itself is rated at a minimum 300,000 copies although Canon estimate it will prove better than this in life-cycle tests. The standard machine comes with half a megabyte of memory and. £500 will buy you another megabyte, enabling you to handle A4 sized, bit-mapped graphics.

Fig 1 – The Canon LBP-8II

Figure 2 – Flush, skin-type switches on the six-switch Cannon main control panel.



Features

From such a pleasant and well constructed machine it is therefore rather disappointing to find that it has very unspectacular features. The basic model comes with Diablo *630* emulation only, although if you are using an IBM PC you can get a "printility" disc, which will provide Hewlett Packard *LaserJet Plus* emulation. Likewise the range of built-in fonts is extremely modest: *Courier* (the fixed-pitch typewriter font), in Roman, Bold, Italic or a small-size foot note, available in portrait or landscape orientation and in nine languages plus two IBM character sets. However the range of font cartridges is extensive: sixteen are already available plus another ten on the way, each costing £190. The machine is certainly as fast as claimed: in fact it slightly exceeded its rated eight pages per minute and even managed seven pages from a standing start.

Control Panel

The control panel is highly effective but not nearly so simple to use on the Panasonic's. Additionally there are indicators to indicate power on and warm up. The buttons are: On-line/off-line Form-feed and Four dual-purpose buttons which, in one mode: Continue printing after a stoppage caused by an error Print a test sheet or a list of fonts currently in the machine Reset the machine parameters and Enter menu mode. And in the other moves through the menu tree, either up or down to another level of menu or "sideways" through the various options on a given level. Setting menu items would be much easier if the handbook was more adequate and gave, for example, a menu "family tree". It covers the basic operations like: Selecting the interface, with baud rates ranging up to 19200 and choice of communication parameters, with **ETX** as an option in addition to **DTR** and **xon-xoff**. Saving current printer settings for resumption after switch-off Resetting to factory values Loading fonts from cartridges Switching "Daisy Wheel" which means, essentially, using a different national character set Switching between landscape and portrait orientation. Selecting **boldface**; if no bold font is present there is an internal macro that you can use instead and Setting page margins. Setting the number of print copies. This, which should be a straightforward task as it is frequently done, requires quite an elaborate journey around the menu tree and involves a total of some dozen switch pushes in all; most unergonomic!

The system has two niggling faults, firstly, there is no provision for choosing the setting at "switch-on". Instead it automatically stores the current setting when it is switched off. This is rather a nuisance. If the last task of the day is something special the first user next morning will need to reconfigure to normal settings. A better arrangement is one where you save the chosen settings, then need only switch off and on again to reinstate them. The second irritation is that the only way to exit from a given menu level is to find the "exit" menu item. No problem if there are only two or three choices on a menu level but when selecting

one of twenty-three different character sets you may have to make twenty-two further button presses before you can escape.

Features

The machine has a generous variety of emulations and multiple character sets. However the range of built-in fonts is rather limited (see Fig 6) Without downloading fonts from your computer, or using font cartridges, you can only get three different type faces and only one of them, a fixed pitched *Brougham* has any variation in size, although it does go up to 14 point for titles (slightly larger than the Star machine). The only proportionally spaced type-face, called *Anelia*, is available in twelve point alone; it seemed to me a serious omission that you could not use a ten-point, proportional spaced type face.

Font cartridges will cover Helvetica, Times Roman, Gothic, Caslon and Orator. They are not as yet available, although you could always use standard Hewlett Packard cartridges if you do not mind paying their rather high prices. There are few exciting features: you can do bit-image graphics but no other type; there is no graphics language. This machine is strictly for the standard office environment where there is no demand for special work of any sort.

Handbook

The handbook comes in four parts: The operating manual itself is clear and simple but takes far too many pages to describe the very basic operations of setting up, replacing a cartridge and so on, leaving insufficient space for more advanced yet still essential detail. A tutorial guide that describes the process of software control of printing, using BASIC programs and A volume on configuring the printer via the control panel. Although they are nicely produced, in A5 format, with excellent line illustrations, none of them is at all adequate. Many important topics are omitted or dealt with sketchily, for example the use of the vector graphics capability is almost completely omitted. It tells you how to draw rectangular boxes but virtually nothing else and the poor treatment of macros has been lamented above. Although the contents lists are detailed there is no index and this caused much frustration.

Assessment

I felt that this was a good printer and I was not getting fully at its capabilities due to its poor documentation. It is well built and will stand up to all reasonable office conditions. Operating costs are low but, if you want more than the most basic range of fonts you will actually pay nearer £3000 than £2000 for the machine with extra font cartridges and extra memory.

Figure 3 – The Star Laserprinter 8

Star LaserPrinter 8

Star have performed very well in recent printer reviews so I was interested to see what kind of laser machine they would offer. They have gone for the Canon LBP-SX engine (Fig 3) and even retained Cannon's standard control panel, with slight cosmetic changes. They have provided a generous megabyte of memory, with a second megabyte optional, in anticipation of a *PostScript* version, due in the summer. *PostScript* will come on a cartridge, so if you buy the basic machine now no investment will be wasted but prices of this, the memory board and the standard font cartridges have yet to be announced. At present bit-image is the only graphics available.

The range of resident type styles (Fig 4) is restricted to those required for standard office use, namely 12 point *Courier*, which is the largest, and twelve pitch *Prestige* as an alternative for office correspondence. There is a fully proportional *Times Roman* with italic and bold and also a 16.6 inch pitch line-printer type face, also available in italic, bold and bold italics. If you want anything more than this you have to go to one of the seven cartridges covering the standard Hewlett Packard range- Pica, Elite, Helvetica, Gothic, Script, Caslon and Orator.

The cartridges will be 512K each, twice the size and holding more fonts than standard HP *Laserjet Plus* cartridges. However the range of sizes is rather limited (six point to eighteen point), with thirteen country character sets. For larger characters and some graphics, Star recom-

Figure 4 – Range of resident type styles on the Star Laserprinter 8

THE STAR LASERPRINTER 8 - TYPE STYLES

Without cartridges installed Courier

12 point is the largest available

and this is in 16.6 inch pitch Lineprinter typeface

Also available in italic; note the spacing is fixed

and this one is also available in bold *and bold italics*

TIMES ROMAN typeface: only available in 10 point

This is Times Italic; spacing is proportional

and now in bold *and also in bold italics*

PRESTIGE 12 pitch typeface

it can be in italic but not bold

This is the Brother HL-8 printer with the lid up exposing the paper feeding mechanism and the laser mechanism. The control panel is situated to the bottom left of this picture whilst the paper tray is in the middle left of the picture.

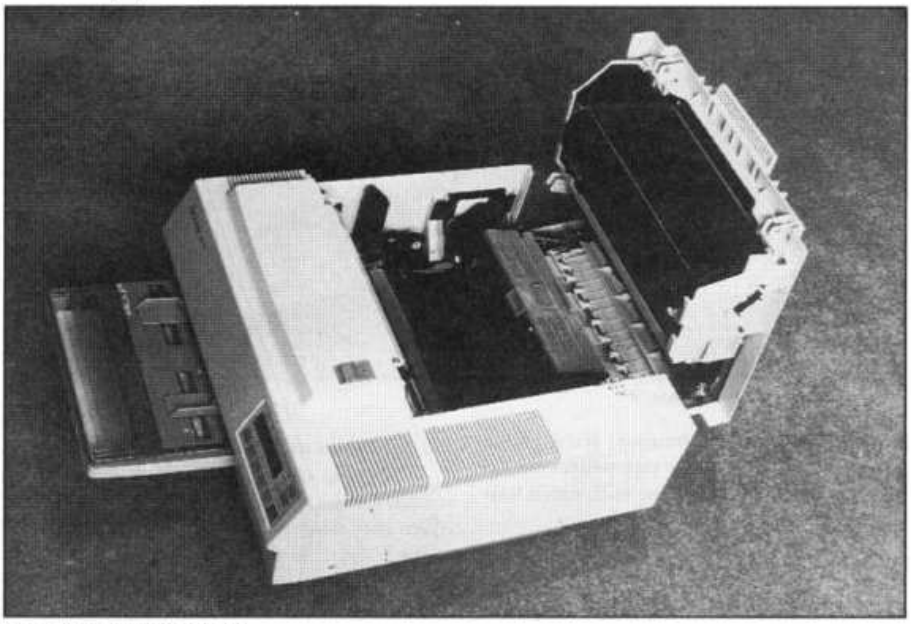


Figure 5 – The Brother HL-8

mend you contact a company named Fontware, (Fareham 0329-221121) but I understand their product is only usable on a PC clone. The good points about this machine were the control panel and the handbook (I managed to master the former without opening the latter!). The sixteen-character liquid-crystal display, has intensity ranges between 1 and 7 of which 1, the strongest contrast, was readable in any of the lighting conditions in my office. Of the buttons, one is on-line and one is print, one resets after an error, one tests and one resets the machine without cutting power.

My only criticism was that the entry for setting the number of copies is embedded too deeply in the menu. You actually need nine separate key presses to get to that part of the menu. How much better if this could have been put right at the top of the menu tree, as it is so frequently used. Having said that, there are some excellent features on the menu: particularly that there are several ways of saving the settings: Factory settings are held in ROM thus can always be found within the menu structure.

Alternatively you can retain the settings in RAM (as long as the printer is on). You could also save them as the power-on set-up. Probably you would save the standard office correspondence settings in this way, so that unskilled office staff would not have to reset the machine at all. Or you could override all settings by sending software codes from your computer. The machine offers emulations of Diablo-*630*, IBM *Proprinter* or Epson *EX-800*. Most people will probably use the Hewlett Packard *Laserjet Plus* emulation, as it's the most versatile.

Figure 6 – The range of built-in fonts on the Brother HL-8 Hewlett Packard LaserJet Plus emulation.

THIS IS A TEST OF
THE BROTHER HL-8
This is 10 point BROUGHAM type
in 10 pitch
and this is in sixteen pitch which also alters the point size
Twelve pitch italic; note the spacing is fixed
and now in eight pitch bold
And now ANELIA typeface: only available
in 12 point
This is in italic; spacing is proportional
and now in bold and bold italics
LETTER GOTHIC TYPEFACE: 16.6 pitch which can also be
In italic or in bold or even in bold italic

Handbook

The handbook comes in a convenient A5 size, spirally bound so that it stays open at the page you are using and contains everything within the one document (although a second volume is planned, with more details of running applications packages).

There is a proper index at the back although I felt it could have been a little more comprehensive. There is also substantial, twenty-four page chapter devoted solely to trouble-shooting with clear, generous illustrations. Full details are given of how to use the menu and there is an excellent "menu-map", on a double spread, that shows you the whole scope of the menu. There is also a complete, detailed description of all the software commands for each emulation, although I would like to have seen rather more explanation of how the software codes work; in particular the rather awkward rules of precedence for the HP *Laserjet Plus* emulation.

One final plus point was that the test sheet was more detailed and informative than any other I have come across. It gives samples and details of all fonts in the printer: whether they be resident, held on either of the two font cartridges or downloaded from the computer. It then gives a status and set-up report, covering every setting (the current one, the initial one, the power-up setting and the factory setting) and every item on the menu. This covers four emulations (of which the HP *Laserjet Plus* is actually two because there is a "primary" and a "secondary" font), and contains an awful lot of space (and demonstrates the virtue of the very small, sixteen pitch line-printer font for doing detailed tables). Finally it records the current status of memory available and any history of errors.

Assessment

This is the best machine I have seen based on the Canon engine. For £2195 you get a first class engine, a very good controller with a an excellent control panel and menu system, an intelligent selection of resident fonts for either office work, detailed tabular work or simple type-setting. If you need more than this then there is a wide choice of cartridges and the prospect of *PostScript* on cartridge in due course. Its only shortcoming, compared to the Brother *HL-8* is the absence of any resident font larger than 12 point for doing titles. Between the menu, its excellent display and a very good handbook the machine is particularly simple to use and I feel it's good value for money.

Brother HL-8

This is another machine that uses the excellent Canon engine (Fig 5) and again I was impressed with its paper handling. Despite warnings in the handbook against doing so, it happily coped with a sheet of A4 paper which had been crumpled and then smoothed out. It also manually fed A4 envelopes, without any of the handbook's precautions (designed to prevent paper in the main cassette stack from being fed) being necessary. It achieved six fully printed sides of A4 in the first minute, taking seventeen seconds to deliver the first one which means the later ones arrived slightly slower than the claimed eight pages per minute.

Assessment

I was disappointed that Brother, who are normally an enterprising manufacturer, should be so unambitious in customizing the excellent Canon engine into a rather dull, featureless, "bog standard" printer. However if you never want to do anything except straightforward office correspondence you will not mind these limitations.

Control Panel

Brother have provided their own control panel with a sixteen character liquid crystal display and eight flush, membrane type switches, each of which has a satisfactory positive click. However the display gave me problems. Although there are seven degrees of contrast, none of them is adequate unless the control panel is directly facing a good light source. The panel is almost vertical so this is quite difficult to arrange.

British Telecom MP 2006

This machine missed the first half of this review due to pressures of time, etc. When put on test it performed self-test satisfactorily but then manifested two serious defects: The paper select function on the control panel did not work and, if attempted, cause the whole control panel to cease functioning until it had been switched off and on again. The machine would not print. Both the file I transmitted to it and the serial connection were those which I had just used, successfully, on the Brother HL-8, with no hint of trouble, so I felt reasonably confident the machine, not I, was at fault.

You cannot set the printer parameters from the control panel; instead there are old-fashioned dip switches, on the serial interface cartridge. I confirmed that these were correctly set and informed British Telecom. They sent me a new "personality module" ("interface cartridge" in old-speak), which corrected both errors and I was at last able to review the machine. From the handbook I discovered that this machine takes badge engineering yet a further step. Not only does it employ the Ricoh engine (Fig 9), which I have criticised in the first part of this article (see last issue) for frailty (Fig 8) , but it **is** actually the OKI *Laserline 6*, with a British Telecom badge replacing the OKI badge on the front (Fig 10).

Because it is intended for use with British Telecom PC-compatible computers it is not a wise choice for other users, for the following reason. If you want to alter the emulation, font, paper orientation or layout or any of a number of matters, then you either use a PC program called *Laser Control*, which configures the machine for you without tears or else you must transmit raw Hewlett Packard *LaserJet Plus* escape codes from your computer. There is no way of doing these things from the control panel. As explained above, the control codes are pretty nasty; you really want a bit of friendly software to handle them for you.

The control panel is the least versatile and least helpful of any of the printers I tested in this review. It contains nine indicator lights which show paper size, manual or automatic paper feed, whether the machine is ready to print, whether it is on line, whether toner or drum needs replenishment and whether a form feed signal is required. Then there are five buttons for: switching on and off line, to resume affairs after an error message, form feed, paper selection and self-test.

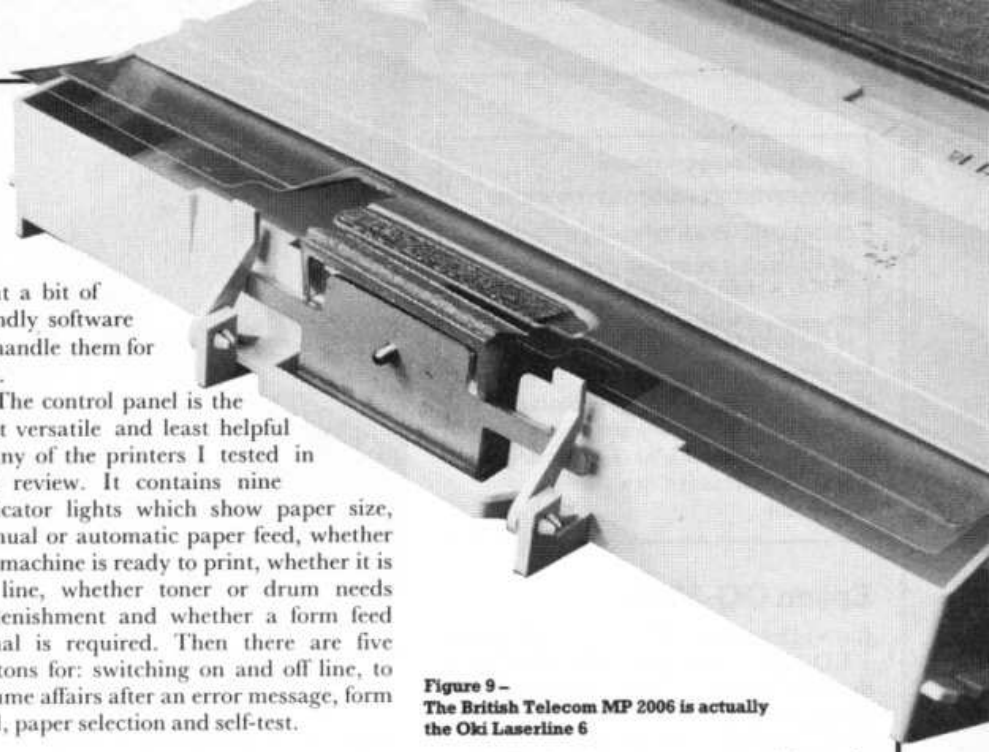


Figure 9 – The British Telecom MP 2006 is actually the Oki Laserline 6

Assessment

This machine combines the poor design and manufacturing quality of the Ricoh engine with extremely limited control functions and, if my personal experience is typical, chronic unreliability of operation. Yet it is priced at the £1900 mark. I would not recommend it for any would-be purchaser but it is particularly unsuitable for BBC or other non IBM PC compatible users.

Conclusion

I had expected that this review would be difficult to complete: with so many models of printer I had expected there to be little to choose between them. I could not have been more wrong. The Panasonic *KX-P4450* is the best buy by a staggeringly large margin. It is priced within the same range as the others and cheaper than many, yet operates at significantly higher speed, is much more solidly built, has two generous input cassettes, a superb menu-operated control panel with a liquid crystal display that you can actually read in normal office light and the promise of *PostScript* without loss of your existing investment within a few months.

Of the other machines, those that use the Canon engine, notably the Star *LaserPrinter 8*, the Brother *HL8* and the Cannon LBP-8II are well made and operate well at or slightly above eight pages per minute. I regard the Star as the best of the bunch.

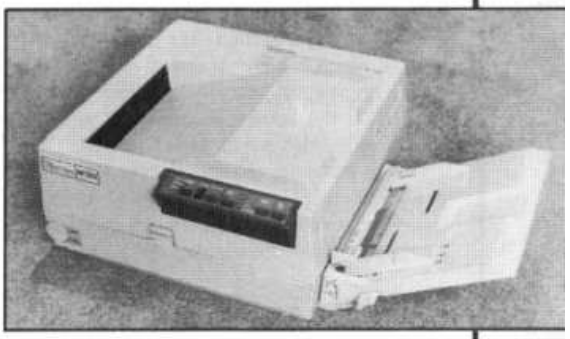


Figure 8 – Fragile plastic mouldings on the paper input hopper of the Ricoh engine.

Figure 7 – To produce Figure 6 I had to use these horrible codes.

```
ESC(s8.3H ESC&k8S ESC(s0S ESC(s3B
TYPE FACES ON THE BROTHER HL-8

ESC)s10V ESC&k0S ESC(s0B ESC(s10H
This is 10 point BROUGHAM type in 10 pitch
ESC&k2S
and this is in sixteen pitch which also alters the point size
ESC&k4S ESC(s1S
Twelve pitch italic; note the spacing is fixed
ESC&k8S ESC(s0S ESC(s3B
and now in eight pitch bold
ESC(s1P ESC(s129T ESC)s10V ESC&k0S ESC(s0B
And now ANELIA typeface: only available in 12 point
ESC&k4S ESC(s1S
This is in italic; spacing is proportional
ESC&k8S ESC(s0S ESC(s3B
and now in bold ESC(s1Sand bold italicsESC(s0S
ESC(s0P ESC(s16.6H ESC&k2S ESC(s0B ESC(s130T
LETTER GOTHIC typeface: only in 16.6 pitch but
ESC(s1S
it can also be in italic or in ESC(s0SESC(s3Bbold or even in
ESC(s1Sbold italic
```

Mark Webb

abcdefghijklmnopqrstuvwxyz

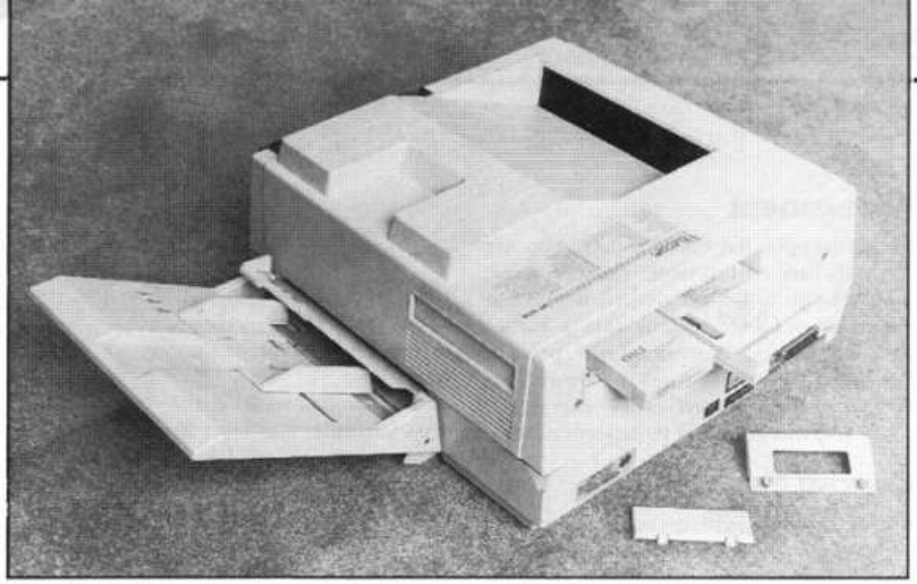
ABCDEFGHIJKLMNOPQRSTUVWXYZ

0123456789!"#$%&'()*+,-./:;<=>?@{|}~

DATATHORN SYSTEMS LTD
EPSON LASER PRINTER SPECIALISTS

We supply a wide range
of GQ fonts and accessories

Datathorn Systems' range of fonts for the Epson printer are impressive to say the least, this particular one is called EM07TNP arranged in a portrait orientation.



The British Telecom laserprinter with its two cartridges installed. Printer parameters are not set from the control panel – instead they are set from the second cartridge (the serial interface) using the old style method of setting dip switches.

Epson GQ-3500

Jon Vogler regrettably had trouble getting a GQ-3500 from Epson. The following is therefore based on Jon's assessment from seeing the printer at the Which Computer Show and our own use of the GQ-3500 over the past 6 months.

Construction

The *GQ-3500* uses the same Ricoh engine as the Olympia, Oki and Ricoh models but there have been some modifications, made to Epson's own specification. The moulded paper-out tray on the machine lid is distinctively grooved and the cooling louvres on the delivery end of the machine are altered. This makes the end-panel extremely flexible. A folding, face-up paper-out tray is fitted but it is weak and flexible. The machine has many of the defects that I have pointed out on the Ricoh engine, in particular those associated with the frailty and lack of smooth operation of the paper input hopper (See Figure 8 but note that it was taken on the British Telecom machine). The built-in interface is parallel and an RS-232 interface is optionally available.

Control Panel

The control panel is reduced to various indicator lights plus five buttons and a two-digit status display. One of the buttons is used in combination with an optional 250-sheet paper loading tray which can be used in combination with the standard 150-sheet tray, to give double-bin feeding. One of them controls **on-line**and **off-line**and the others operate **error recovery**, **form feed**and, in conjunction with the fifth shift key, a "Selec-Type" system, not dissimilar to that familiar from Epson dot-matrix printers. With these you can alter the print font, number of copies to be printed and paper size or orientation (portrait or landscape).

Fonts and Emulations

The only built-in emulations are HP *LaserJet Plus* (which comes on a ROM card or Epson (the LQ2300 not FX80); *Diablo 630* emulation is available as an option. There is a wide range of type sizes available on cards, from six to twenty-four point, but only four sizes built-in: *Courier* -12 and a compressed (8.5 point) line printer mode using HP LaserJet Plus emulation and ten point *Courier* and "EDP" mode using Epson emulation. All the other fonts: *Prestige, Helvetica, Times Roman* and various others require font cartridges and these are expensive. Like emulation cards they cost £125 each and do not necessarily contain very many extra fonts. For example you pay £125 for Helvetica in sizes between eight and twelve point, plus Helvetica Oblique in ten and twelve point, but that only gives you landscape mode: if you want the same in portrait mode you have to pay another £125!

There is a vector graphics facility, as well as bit-image graphics, but its command range is strictly limited: production of circles or arcs, straight lines or boxes and the ability to paint an area with various sorts of in-fill. Standard memory is 640K with 2 megabytes optional memory upgrade available, which suggests that a *PostScript* version is planned. The 2 megabyte memory upgrade costs £440 extra, as does the 250-sheet input-tray. Price of the basic machine is £1795 with another £95 if you want a serial interface.

Assessment

It is the cheapest laser printer currently available. Nothing that I have seen leads me to suppose that it is significantly superior to the other machines that use the Ricoh engine and the controller appears to offer far less than the excellent board on the Olympia *Laserstar 6*.

Datathorn Support

The Epson GQ-3500 is now the best selling laser printer in the UK, after the Hewlett Packard range, and it is therefore beginning to attract a range of support essential for BBC Micro owners. Due to the work done by Datathorn, BBC owners can obtain a range of downloadable fonts which compare very favourably in price with both Postscript and Hewlett Packard fonts sold to business users. The BBC Micro lacks the range of software which can directly call up these fonts but flexible programs such as Interword, in which *escape* code sequences can be edited, can select and swap fonts from within a document.

Datathorn provided us with an assortment of Times Roman and Helvetica style fonts, from a total of 39 now available. The data is sent to the printer via a loader program and the fonts are then available for selection. The larger font designs have real impact – there's nothing like them for dot matrix. The proportional fonts are very attractive. Tabulation in a word-processor will not work well but the printer's own tabulation facilities can be used to line up columns.

Datathorn also supply a graphics dump program which can get around the problem of having no FX80 emulation in the GQ. Your old graphics dumps won't work with the Epson GQ so Datathorn's QstDmp program (£12.50 + VAT and £3.50 P&P) is essential. Saved Mode 1 screens (Mode 0 for the Archimedes) are sent to the printer memory for printing via the usual escape code commands. The dump can be scaled and positioned and initiated from within a text file. You can even overlay text onto a graphic. Like the fonts, QstDmp is easy to use via on-screen menu options.

Taking advantage of the GQ's line drawing abilities, is a neat forms program for both BBC Micro and Archimedes. Also announced is a label printing package. Upgraders will find that label printing programs designed for the "Epson compatible" dot matrix printers do not work so this product will be welcome for business users.

Using the Hewlett Packard Laserjet Plus emulation, it is possible to dump graphics from a PC package running on Master 512 or Archimedes PC emulation. Anyone wishing to use PC desktop publishing packages however will certainly need to invest in the memory upgrade for the GQ.

Details of BBC fonts and software from Datathorn Systems Ltd, George House, 50 Sprint Grove, Loughton, Essex IG10 4QD. ☎ 01 508 4904.

ORGANISED INSERTION

Modan – Module Analyser

The Archimedes module analyser utility was used to produce this month's special technical pullout on the Archimedes. It uses the SWI "OS Module" call with R0 = 12 to extract information about all of the currently active modules.

This call returns information about the required module and returns with R3 pointing to the module start. R4 contains the contents of the module's private word. R1 and R2 contain the module number and incarnation number of the next module, which is used to get the parameters for the next module.

The program calls this routine repeatedly until the last module is reached, which means the end of the run.

On returning the parameters for each module, using the FNextract procedure, the procedure report-header displays all of the relevant information in the module header.

The header contains the following information:

Start Code – This is the offset from the start of the module of the code which is executed if the module is to be started as the current application (i.e. a utility).

Initialisation Code – This code is executed when the module is first loaded. It usually claims any workspace the module may need later, and performs any other set up procedures.

Finalisation Code – This code is called when the module is killed or Re-initialised; workspace would be freed here, and any vectors or other resources claimed by the initialise routine would be released.

```
Module                : Utility
Module (ROM based)
Module no             : 1
Module incarnation    : 0
Help String           : MOS Utilities
                        1.20 (25 Sep 1987)
Start Code            : &0380AD44
Workspace At          : &00000000
Initialisation Code   : &038062BC
Finalisation Code     : &038062D8
Service Call Handler  : &038062BC
Help Table            : &03806342
No Software Interrupts Installed For
This Module

Command               : Configure
Code Start            : &0380B898
Information Word      : &20FF0000
Min Parameters        : 0
Max Parameters        : 255
Help Code             : &0380B828
Syntax Code           : &038062BC

Command               : Commands
Code Start            : &038062BC
Information Word      : &20000000
Min Parameters        : 0
Max Parameters        : 0
Help Code             : &03806EDC
Syntax Code           : &038062BC

Command               : Echo
Code Start            : &03806EA8
Information Word      : &00FF0000
Min Parameters        : 0
Max Parameters        : 255
Help String           : &03806A6B
Syntax String         : &038062BC

Command               : Error
Code Start            : &0380711C
Information Word      : &00FF0001
Min Parameters        : 1
Max Parameters        : 255
Help String           : &03807094
Syntax String         : &038070C8

Command               : Eval
Code Start            : &0380716C
Information Word      : &00FF0001
Min Parameters        : 1
Max Parameters        : 255
Help String           : &038070E7
Syntax String         : &03807101

Command               : FileCommands
Code Start            : &038062BC
Information Word      : &20000000
Min Parameters        : 0
Max Parameters        : 0
Help Code             : &03806EF8
Syntax Code           : &038062BC

Command               : GOS
Code Start            : &03807074
Information Word      : &00000000
Min Parameters        : 0
Max Parameters        : 0
Help String           : &03801586
Syntax String         : &038015B5

Command               : IF
Code Start            : &03807B94
Information Word      : &00FF0002
Min Parameters        : 2
Max Parameters        : 255
Help String           : &03807AFC
Syntax String         : &03807B5B

Command               : Ignore
Code Start            : &03807260
Information Word      : &00010000
Min Parameters        : 0
Max Parameters        : 1
Help String           : &03806AA2
Syntax String         : &03806ACD

Command               : Modules
Code Start            : &03806B1D8
Information Word      : &20000000
Min Parameters        : 0
Max Parameters        : 0
Help Code             : &03806B40
Syntax Code           : &03806662

Command               : RMClear
Code Start            : &03806B28
Information Word      : &00000000
Min Parameters        : 0
Max Parameters        : 0
Help String           : &038067NB
Syntax String         : &038067B5

Command               : RMKill
Code Start            : &03806AE8
Information Word      : &00010001
Min Parameters        : 1
Max Parameters        : 1
Help String           : &03806673
Syntax String         : &038066A3

Command               : RMLoad
Code Start            : &03806B04
Information Word      : &00FF0001
Min Parameters        : 1
Max Parameters        : 255
Help String           : &038066C1
Syntax String         : &038066F5

Command               : RMReInit
Code Start            : &03806B34
Information Word      : &00FF0001
Min Parameters        : 1
Max Parameters        : 255
Help String           : &038067C6
Syntax String         : &03806824

Command               : RMRun
Code Start            : &03806B10
Information Word      : &00FF0001
Min Parameters        : 1
Max Parameters        : 255
Help String           : &03806710
Syntax String         : &03806732

Command               : RMTidy
Code Start            : &03806B1C
Information Word      : &00000000
Min Parameters        : 0
Max Parameters        : 0
Help String           : &0380674C
Syntax String         : &0380677B

Command               : ROMModules
Code Start            : &038072BC
Information Word      : &00000000
Min Parameters        : 0
Max Parameters        : 0
Help String           : &03806844
Syntax String         : &03806899

Command               : Set
Code Start            : &03806E21
Information Word      : &00FF0002
Min Parameters        : 2
Max Parameters        : 255
Help String           : &03806SAD
Syntax String         : &03806SDD
```

Service Call Handler – This points to the code used to process service calls to the module.

Title String – This is the offset from the start of the module to a null terminated string, this is the title, the name by which the module is addressed – i.e. RMKILL title.

Help String – This is the string displayed when *HELP MODULES is executed. The format of this string is defined by Acorn in order to keep the display tidy.

Command table – This is the offset of a list of command definition blocks. This table is interpreted by the program if commands are implemented.

SWI chunk base – This is the base number of the 64 SWIs allocated by Acorn to the module. e.g. &40380 is the Debugger SWI list base.

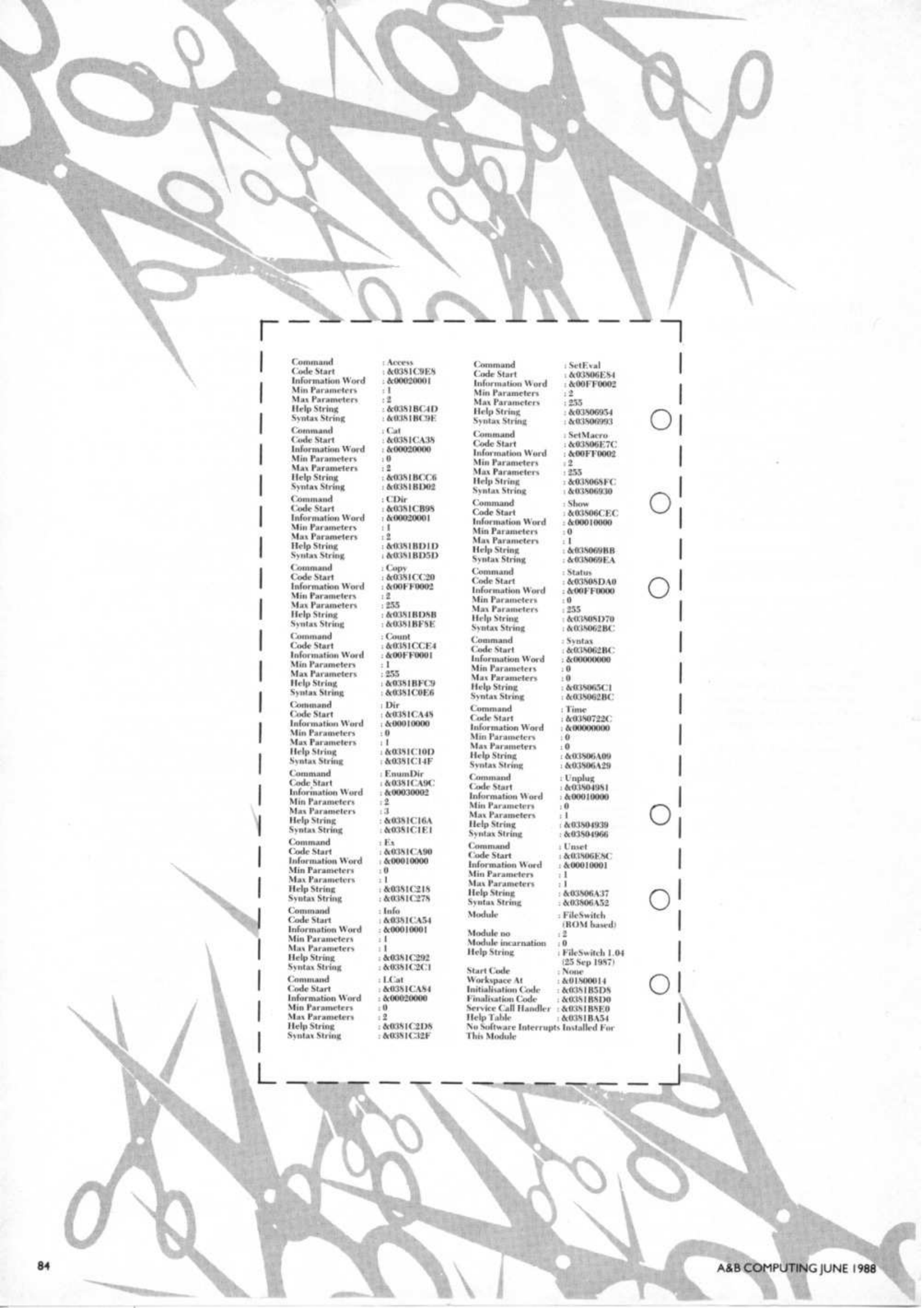
SWI handler code – Called if a SWI belonging to this module is detected by the operating system.

SWI decoding table – A list of null terminated strings which translate into the SWI numbers e.g. SWI 0 translates into SWI "OS--WriteC".

SWI decoding code – Code called by OS when decoding to/from SWI strings.

The commands installed by the module are then listed, in order of occurence, together with: Code start: address called when the command is issued. Information Word – Word containing flags and parameter number limits for the command. Max and Min number of parameters. Address of help code/text. Address of invalid syntax string. The output pauses after each screenful, restart by pressing <SHIFT>. To send the output to the printer, you can replace the VDU 14 at the beginning of the code with a VDU 2. The program should prove very useful to anyone wishing to examine the commands supplied in ROM and possibly gain a better understanding of how modules work and how to write them.

The Module Analyser program is available on the Red Keys 2 disk advertised in this magazine.



```
Command          : Access
Code Start       : &0381C9E8
Information Word : &00020001
Min Parameters   : 1
Max Parameters   : 2
Help String      : &0381BC4D
Syntax String    : &0381BC9E

Command          : Cat
Code Start       : &0381CA38
Information Word : &00020000
Min Parameters   : 0
Max Parameters   : 2
Help String      : &0381BCC6
Syntax String    : &0381BD02

Command          : CDir
Code Start       : &0381CB98
Information Word : &00020001
Min Parameters   : 1
Max Parameters   : 2
Help String      : &0381BD1D
Syntax String    : &0381BD5D

Command          : Copy
Code Start       : &0381CC20
Information Word : &00FF0002
Min Parameters   : 2
Max Parameters   : 255
Help String      : &0381BD8B
Syntax String    : &0381BF8E

Command          : Count
Code Start       : &0381CCE4
Information Word : &00FF0001
Min Parameters   : 1
Max Parameters   : 255
Help String      : &0381BFC9
Syntax String    : &0381C0E6

Command          : Dir
Code Start       : &0381CA48
Information Word : &00010000
Min Parameters   : 0
Max Parameters   : 1
Help String      : &0381C10D
Syntax String    : &0381C14F

Command          : EnumDir
Code Start       : &0381CA9C
Information Word : &00030002
Min Parameters   : 2
Max Parameters   : 3
Help String      : &0381C16A
Syntax String    : &0381C1E1

Command          : Ex
Code Start       : &0381CA90
Information Word : &00010000
Min Parameters   : 0
Max Parameters   : 1
Help String      : &0381C218
Syntax String    : &0381C278

Command          : Info
Code Start       : &0381CA54
Information Word : &00010001
Min Parameters   : 1
Max Parameters   : 1
Help String      : &0381C292
Syntax String    : &0381C2C1

Command          : LCat
Code Start       : &0381CA84
Information Word : &00020000
Min Parameters   : 0
Max Parameters   : 2
Help String      : &0381C2D8
Syntax String    : &0381C32F

Command          : SetEval
Code Start       : &03806E84
Information Word : &00FF0002
Min Parameters   : 2
Max Parameters   : 255
Help String      : &03806954
Syntax String    : &03806993

Command          : SetMacro
Code Start       : &03806E7C
Information Word : &00FF0002
Min Parameters   : 2
Max Parameters   : 255
Help String      : &038068FC
Syntax String    : &03806930

Command          : Show
Code Start       : &03806CEC
Information Word : &00010000
Min Parameters   : 0
Max Parameters   : 1
Help String      : &038069BB
Syntax String    : &038069EA

Command          : Status
Code Start       : &03808DA0
Information Word : &00FF0000
Min Parameters   : 0
Max Parameters   : 255
Help String      : &03808D70
Syntax String    : &038062BC

Command          : Syntax
Code Start       : &038062BC
Information Word : &00000000
Min Parameters   : 0
Max Parameters   : 0
Help String      : &038065C1
Syntax String    : &038062BC

Command          : Time
Code Start       : &0380722C
Information Word : &00000000
Min Parameters   : 0
Max Parameters   : 0
Help String      : &03806A09
Syntax String    : &03806A29

Command          : Unplug
Code Start       : &03804981
Information Word : &00010000
Min Parameters   : 0
Max Parameters   : 1
Help String      : &03804939
Syntax String    : &03804966

Command          : Unset
Code Start       : &03806E8C
Information Word : &00010001
Min Parameters   : 1
Max Parameters   : 1
Help String      : &03806A37
Syntax String    : &03806A52

Module           : FileSwitch
                   (ROM based)
Module no        : 2
Module incarnation : 0
Help String      : FileSwitch 1.04
                   (25 Sep 1987)
Start Code       : None
Workspace At     : &01800014
Initialisation Code : &0381B5D8
Finalisation Code : &0381B8D0
Service Call Handler : &0381B8E0
Help Table       : &0381BA54
No Software Interrupts Installed For
This Module
```

Command : LEx
Code Start : &0381CA60
Information Word : &00010000
Min Parameters : 0
Max Parameters : 1
Help String : &0381C34B
Syntax String : &0381C3C6

Command : Lib
Code Start : &0381CA6C
Information Word : &00010000
Min Parameters : 0
Max Parameters : 1
Help String : &0381C3E1
Syntax String : &0381C437

Command : Opt
Code Start : &0381C960
Information Word : &00020000
Min Parameters : 0
Max Parameters : 2
Help String : &0381C8C1
Syntax String : &0381C940

Command : Rename
Code Start : &0381CA14
Information Word : &00020002
Min Parameters : 2
Max Parameters : 2
Help String : &0381C452
Syntax String : &0381C479

Command : Run
Code Start : &0381CA78
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &0381C49D
Syntax String : &0381C4E8

Command : SetType
Code Start : &0381CB60
Information Word : &00020002
Min Parameters : 2
Max Parameters : 2
Help String : &0381C50F
Syntax String : &0381C53E

Command : Shut
Code Start : &0381CA20
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &0381C565
Syntax String : &0381C598

Command : ShutDown
Code Start : &0381CA2C
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &0381C5A6
Syntax String : &0381C617

Command : Stamp
Code Start : &0381CB8C
Information Word : &00010001
Min Parameters : 1
Max Parameters : 1
Help String : &0381C629
Syntax String : &0381C697

Command : Up
Code Start : &0381CBC4
Information Word : &00010000
Min Parameters : 0
Max Parameters : 1
Help String : &0381C6B1
Syntax String : &0381C70F

Command : Wipe
Code Start : &0381CC94
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &0381C726
Syntax String : &0381C867

Command : FileSystem
Code Start : &0381CE60
Information Word : &40000000
Min Parameters : 0
Max Parameters : 0
Help String : &0381C88D
Syntax String : &0381C88D
This command is a *CONFIGURE option

Module : DeskTop (ROM based)
Module no : 3
Module incarnation : 0
Help String : DeskTop 1.02 (11 Sep 1987)
Start Code : &03821B54
Workspace At : &00000000
Initialisation Code : &03821BFC
Finalisation Code : &03821918
Service Call Handler : &03821944
Help Table : &03821810
No Software Interrupts Installed For This Module

Command : DeskTop
Code Start : &03821B40
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &03821844
Syntax String : &0382186D

Command : DeskFS
Code Start : &03821930
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &0382187E
Syntax String : &038218A9

Module : BASIC (ROM based)
Module no : 4
Module incarnation : 0
Help String : BBC BASIC V 1.02 (25 Sep 1987)
Start Code : &03A3A384
Workspace At : &00000000
Initialisation Code : &03A3A268
Finalisation Code : &03A3A268
Service Call Handler : &03A3A334
Help Table : &03A3A284
No Software Interrupts Installed For This Module

Command : Basic
Code Start : &03A3A324
Information Word : &00FF0000
Min Parameters : 0
Max Parameters : 255
Help String : &03A3A2A0
Syntax String : &03A3A2C8

Module : SystemDevices (ROM based)
Module no : 5
Module incarnation : 0
Help String : System Devices 1.02 (10 Sep 1987)
Start Code : None
Workspace At : &018004E4
Initialisation Code : &0384ADF8
Finalisation Code : &0384B06C
Service Call Handler : &0384AE5C
Help Table : &0384ADAC
No Software Interrupts Installed For This Module No Commands Are Installed By This Module.

Command : Verify
Code Start : &038525C4
Information Word : &80010100
Min Parameters : 0
Max Parameters : 1
Help String : &03852558
Syntax String : &038525A5

Command : Drive
Code Start : &038526EC
Information Word : &40000000
Min Parameters : 0
Max Parameters : 0
Help String : &03852698
Syntax String : &0384BB08
This command is a *CONFIGURE option

Command : Floppies
Code Start : &038527B4
Information Word : &40000000
Min Parameters : 0
Max Parameters : 0
Help String : &03852760
Syntax String : &0384BB08
This command is a *CONFIGURE option

Command : HardDiscs
Code Start : &03852878
Information Word : &40000000
Min Parameters : 0
Max Parameters : 0
Help String : &0385282C
Syntax String : &0384BB08
This command is a *CONFIGURE option

Command : Step
Code Start : &0385295C
Information Word : &40000000
Min Parameters : 0
Max Parameters : 0
Help String : &038528F4
Syntax String : &0384BB08
This command is a *CONFIGURE option

Module : ARMBasicEditor (ROM based)
Module no : 7
Module incarnation : 0
Help String : Basic Editor 1.00 (21 Aug 1987)
Start Code : None
Workspace At : &01802E14
Initialisation Code : &03862D1C
Finalisation Code : &03862DB0
Service Call Handler : &03862DC8
Help Table : &0385B22B
SWI chunk base : &00000000
SWI handler : &0385B1D8
SWI decoding table : &45D30419
SWI decoding code : &66EF2539

Command : ARMBE
Code Start : &0385B7C0
Information Word : &00FF0000
Min Parameters : 0
Max Parameters : 255
Help String : &0385B245
Syntax String : &0385B1D8

Module : WindowManager (ROM based)
Module no : 8
Module incarnation : 0
Help String : Window Manager 1.00 (14 Sep 1987)
Start Code : Nooe
Workspace At : &01504624
Initialisation Code : &038648DC
Finalisation Code : &0386468C
Service Call Handler : &03864920
Help Table : &038646F0
SWI chunk base : &000400C0
SWI handler : &03864948
SWI decoding table : &03864A7C
SWI decoding code : &0386468C

Command : Pointer
Code Start : &03864BF4
Information Word : &00010000
Min Parameters : 0
Max Parameters : 1
Help String : &03864709
Syntax String : &03864868

Module : FontManager (ROM based)
Module no : 9
Module incarnation : 0
Help String : Font Manager 1.00 (14 Sep 1987)
Start Code : None
Workspace At : &0180BE34
Initialisation Code : &03869EB8
Finalisation Code : &0386A0B8
Service Call Handler : &0386A0CC
Help Table : &03869880
SWI chunk base : &00040050
SWI handler : &0386A108
SWI decoding table : &0386A184
SWI decoding code : &03869820

Command : FontList
Code Start : &03869B94
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &03869BC8
Syntax String : &03869BB5

Command : FontCat
Code Start : &03869E60
Information Word : &00010000
Min Parameters : 0
Max Parameters : 1
Help String : &03869915
Syntax String : &03869BF3

Module : SpriteUtils (ROM based)
Module no : 10
Module incarnation : 0
Help String : SpriteUtils 1.00 (08 Sep 1987)
Start Code : None
Workspace At : &00000000
Initialisation Code : &0386D754
Finalisation Code : &0386D754
Service Call Handler : &0386D754
Help Table : &0386D770
No Software Interrupts Installed For This Module

Command : SChoose
Code Start : &0386D940
Information Word : &00010001
Min Parameters : 1
Max Parameters : 1
Help String : &0386D90C
Syntax String : &0386D927

Module : Utility
Module (ROM based) : 1
Module no : 0
Module incarnation : MOS Utilities
Help String : 1.20 (25 Sep 1987)
Start Code : &03806AD44
Workspace At : &00000000
Initialisation Code : &03806ZBC
Finalisation Code : &03806ZD8
Service Call Handler : &03806ZE2
Help Table : &03806342
No Software Interrupts Installed For This Module

Command : Configure
Code Start : &03805B98
Information Word : &20FF0000
Min Parameters : 0
Max Parameters : 255
Help String : &03805B28
Syntax String : &03806ZBC

Command : Commands
Code Start : &03806ZBC
Information Word : &20000000
Min Parameters : 0
Max Parameters : &03806E1DC
Help Code : &03806ZBC
Syntax Code :

Command : Echo
Code Start : &03806EA8
Information Word : &00FF0000
Min Parameters : 0
Max Parameters : 255
Help String : &03806A6B
Syntax String : &03806ZBC

Command : Error
Code Start : &03807116
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &03807094
Syntax String : &03807063

Command : Eval
Code Start : &03807160
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &03807070E7
Syntax String : &03807101

Command : FileCommands
Code Start : &03806ZBC
Information Word : &20000000
Min Parameters : 0
Max Parameters : 0
Help Code : &03806EF8
Syntax Code : &03806ZBC

Command : GOS
Code Start : &03807074
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &03801586
Syntax String : &03801585

Command : IF
Code Start : &03807B94
Information Word : &00FF0002
Min Parameters : 2
Max Parameters : 255
Help String : &03807AFC
Syntax String : &03807B5B

Command : Ignore
Code Start : &03807260
Information Word : &00010000
Min Parameters : 0
Max Parameters : 1
Help String : &03806AA2
Syntax String : &03806ACD

Command : Modules
Code Start : &03806BD8
Information Word : &20000000
Min Parameters : 0
Max Parameters : 0
Help Code : &03806B40
Syntax Code : &03806Z62

Command : RMClear
Code Start : &03806B28
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &03806B78
Syntax String : &03806785

Command : RMKill
Code Start : &03806AE8
Information Word : &00010001
Min Parameters : 1
Max Parameters : 1
Help String : &03806673
Syntax String : &03806A63

Command : RMLoad
Code Start : &03806B04
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &03806F5
Syntax String : &03806ZC1

Command : RMReInit
Code Start : &03806B34
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &03806TC6
Syntax String : &03806524

Command : RMRun
Code Start : &03806B10
Information Word : &00FF0001
Min Parameters : 1
Max Parameters : 255
Help String : &03806710
Syntax String : &03806732

Command : RMTidy
Code Start : &03806B1C
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &03806740
Syntax String : &03806778

Command : ROMModules
Code Start : &03807ZBC
Information Word : &00000000
Min Parameters : 0
Max Parameters : 0
Help String : &03806844
Syntax String : &03806899

Command : Set
Code Start : &03806E21
Information Word : &00FF0002
Min Parameters : 2
Max Parameters : 255
Help String : &03806SAD
Syntax String : &03806SDD

```
Command         : SGet
Code Start      : &0386DD90
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DD48
Syntax String   : &0386DD7A

Command         : SFlipX
Code Start      : &0386DBDC
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DB94
Syntax String   : &0386DBC2

Command         : SFlipY
Code Start      : &0386DC38
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DBF0
Syntax String   : &0386DC1E

Command         : SDelete
Code Start      : &0386D990
Information Word: &00FF0001
Min Parameters  : 1
Max Parameters  : 255
Help String     : &0386D954
Syntax String   : &0386D96E

Command         : SList
Code Start      : &0386D9F8
Information Word: &00000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &0386D9CC
Syntax String   : &0386D9E6

Command         : SLoad
Code Start      : &0386DAD8
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DA94
Syntax String   : &0386DABC

Command         : SMerge
Code Start      : &0386DB3C
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DAEC
Syntax String   : &0386DB1E

Command         : SNew
Code Start      : &0386DB84
Information Word: &00000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &0386DB50
Syntax String   : &0386DB75

Command         : SSave
Code Start      : &0386DD34
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DCF8
Syntax String   : &0386DD18

Command         : SInfo
Code Start      : &0386DDE0
Information Word: &00000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &0386DDA8
Syntax String   : &0386DDD0

Command         : SRename
Code Start      : &0386DC8C
Information Word: &00020002
Min Parameters  : 2
Max Parameters  : 2
Help String     : &0386DC4C
Syntax String   : &0386DC67

Command         : SCopy
Code Start      : &0386DCE4
Information Word: &00020002
Min Parameters  : 2
Max Parameters  : 2
Help String     : &0386DCA0
Syntax String   : &0386DCC1

Command         : ScreenSave
Code Start      : &0386DF24
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DEDC
Syntax String   : &0386DF03

Command         : ScreenLoad
Code Start      : &0386DF88
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386DF3C
Syntax String   : &0386DF68

Module          : SoundDMA
                  (ROM based)
Module no       : 11
Module incarnation : 0
Help String     : SoundDMA 1.10
                  (25 Sep 1987)
Start Code      : None
Workspace At    : &00000000
Initialisation Code : &0386E6B4
Finalisation Code : &0386E820
Service Call Handler : &0386E848
Help Table      : &0386E0A4
SWI chunk base  : &00040140
SWI handler     : &0386E41C
SWI decoding table : &0386E07D
SWI decoding code : &0386E02C

Command         : Audio
Code Start      : &0386E218
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386E0F0
Syntax String   : &0386E11F

Command         : Speaker
Code Start      : &0386E2C0
Information Word: &00010001
Min Parameters  : 1
Max Parameters  : 1
Help String     : &0386E137
Syntax String   : &0386E167

Command         : Stereo
Code Start      : &0386E330
Information Word: &00020001
Min Parameters  : 1
Max Parameters  : 2
Help String     : &0386E181
Syntax String   : &0386E1B7

Module          : SoundChannels
                  (ROM based)
Module no       : 12
Module incarnation : 0
Help String     : SoundChannels
                  1.17 (25 Sep 1987)

Module          : ADFS
                  (ROM based)
Module no       : 6
Module incarnation : 0
Help String     : ADFS 1.02
                  (24 Sep 1987)
Start Code      : None
Workspace At    : &01800604
Initialisation Code : &03850914
Finalisation Code : &03850AE8
Service Call Handler : &03850B64
Help Table      : &03850E78
SWI chunk base  : &00040240
SWI handler     : &03850DBC
SWI decoding table : &03850F2C
SWI decoding code : &0384BB08

Command         : Adfs
Code Start      : &038510F0
Information Word: &00000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &038510AC
Syntax String   : &038510E1

Command         : Back
Code Start      : &03851140
Information Word: &80000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &03851104
Syntax String   : &03851132

Command         : Backup
Code Start      : &038511E4
Information Word: &80040F02
Min Parameters  : 2
Max Parameters  : 4
Help String     : &0385116C
Syntax String   : &038511B2

Command         : Bye
Code Start      : &03851568
Information Word: &80000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &03851514
Syntax String   : &03851559

Command         : Compact
Code Start      : &038515E0
Information Word: &80010100
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03851580
Syntax String   : &038515C0

Command         : Dismount
Code Start      : &038518D4
Information Word: &80010100
Min Parameters  : 0
Max Parameters  : 1
Help String     : &0385186C
Syntax String   : &038518B1

Command         : Drive
Code Start      : &03851A0C
Information Word: &80010101
Min Parameters  : 1
Max Parameters  : 1
Help String     : &038519B4
Syntax String   : &038519F4

Command         : Format
Code Start      : &03851BFC
Information Word: &80030702
Min Parameters  : 2
Max Parameters  : 3
Help String     : &03851B4C
Syntax String   : &03851BB9

Command         : Free
Code Start      : &03851F2C
Information Word: &80010100
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03851EE0
Syntax String   : &03851F0F

Command         : Map
Code Start      : &03852010
Information Word: &80010100
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03851FCC
Syntax String   : &03851FF3

Command         : Mount
Code Start      : &038521F0
Information Word: &80010100
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03852128
Syntax String   : &038521D0

Command         : NameDisc
Code Start      : &03852288
Information Word: &80020302
Min Parameters  : 2
Max Parameters  : 2
Help String     : &0385223C
Syntax String   : &0385225C

Command         : NameDisk
Code Start      : &03852288
Information Word: &80020302
Min Parameters  : 2
Max Parameters  : 2
Help String     : &0385223C
Syntax String   : &0385225C

Command         : NoDir
Code Start      : &03852378
Information Word: &80000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &03852344
Syntax String   : &03852369

Command         : NoLib
Code Start      : &038523C8
Information Word: &80000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &0385239C
Syntax String   : &038523B7

Command         : NoUrd
Code Start      : &03852404
Information Word: &80000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &038523DC
Syntax String   : &038523F3

Command         : Title
Code Start      : &03852460
Information Word: &800A0000
Min Parameters  : 0
Max Parameters  : 10
Help String     : &03852418
Syntax String   : &03852448

Command         : Urd
Code Start      : &03852508
Information Word: &80010100
Min Parameters  : 0
Max Parameters  : 1
Help String     : &038524C8
Syntax String   : &038524EB

                  Finalisation Code : &03852560
                  Service Call Handler : &03852560
                  Help Table      : &038525B4
                  No Software Interrupts Installed For
                  This Module

Command         : HardCopyFX
Code Start      : &03852514
Information Word: &00050000
Min Parameters  : 0
Max Parameters  : 5
Help String     : &03852609
Syntax String   : &03852661

Command         : HardCopyMX
Code Start      : &03852820
Information Word: &00050000
Min Parameters  : 0
Max Parameters  : 5
Help String     : &03852680
Syntax String   : &03852708

Command         : HardCopyRX
Code Start      : &03852828
Information Word: &00050000
Min Parameters  : 0
Max Parameters  : 5
Help String     : &03852757
Syntax String   : &038527AF

Module          : International
                  (ROM based)
Module no       : 15
Module incarnation : 0
Help String     : International
                  1.05 (12 Aug 1987)
Start Code      : None
Workspace At    : &00000000
Initialisation Code : &03852DD0
Finalisation Code : &03852DF0
Service Call Handler : &03852E88
Help Table      : &03852E3C
No Software Interrupts Installed For
This Module

Command         : Alphabet
Code Start      : &03873188
Information Word: &00010000
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03872E48
Syntax String   : &03872F2A

Command         : Country
Code Start      : &03872E8C
Information Word: &00010000
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03872F58
Syntax String   : &03872FF8

Command         : Keyboard
Code Start      : &03873230
Information Word: &00010000
Min Parameters  : 0
Max Parameters  : 1
Help String     : &03873201A
Syntax String   : &03873099D

Command         : Country
Code Start      : &03873FFC
Information Word: &40000000
Min Parameters  : 0
Max Parameters  : 0
Help String     : &03873C0C0
Syntax String   : &03873115E
This command is a *CONFIGURE option
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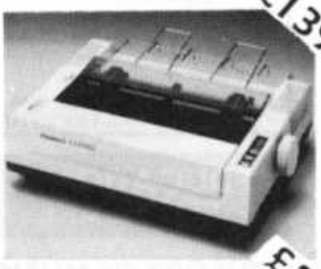

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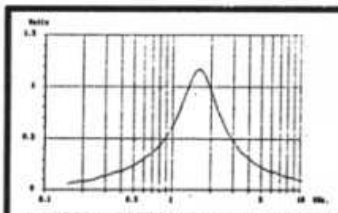

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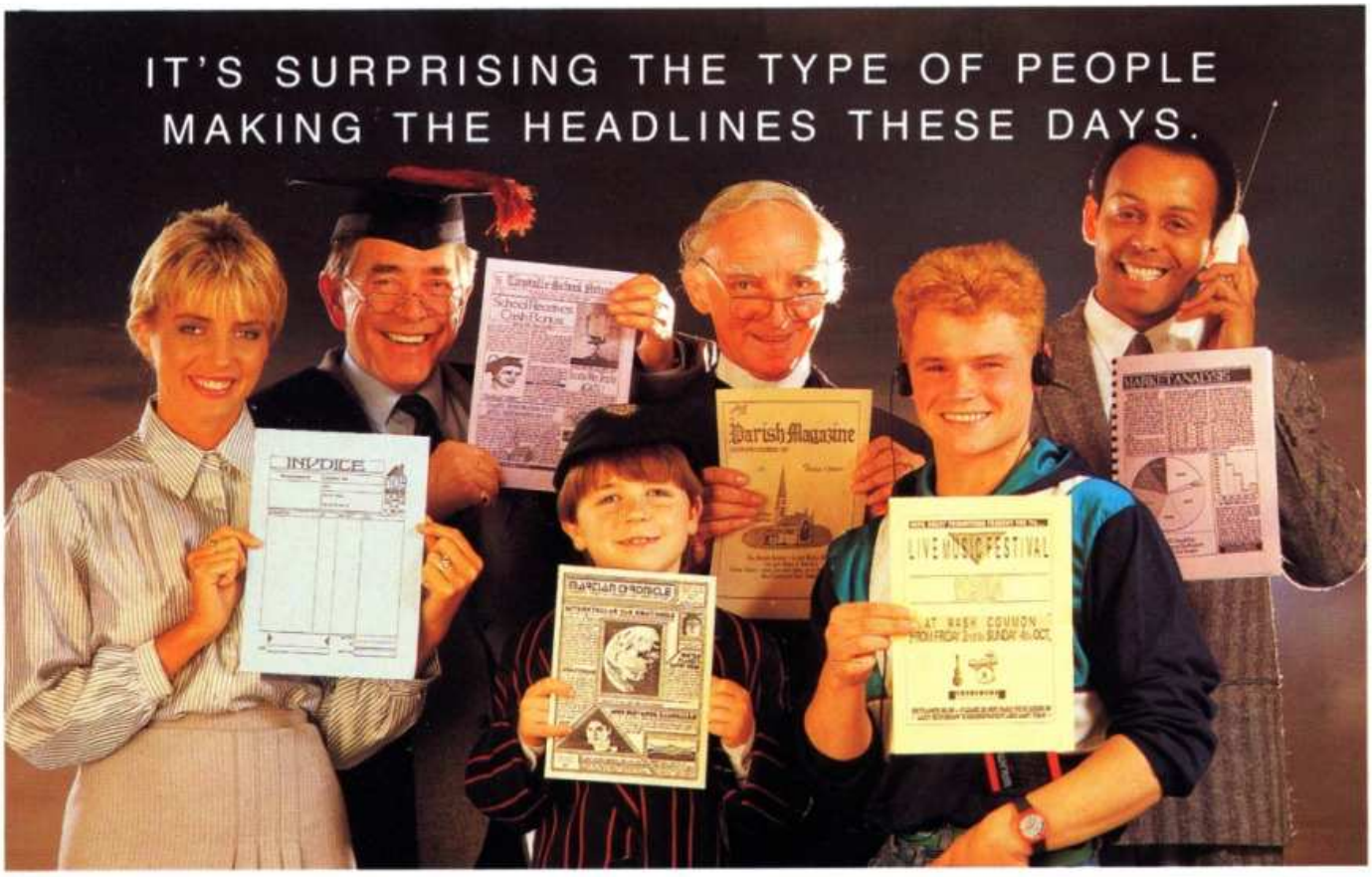

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